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IM6015
4000 Series
Current Clamp Devices

Instruction Manual

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Document History

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1	July 2018	First release	IR
2	January 2020	• Information added for RL4601 Current Clamp • Removal of information on redundant RL4602 and 4603 Current Clamps, DataLoggers and RadioLog.	IR

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1 Introduction

This Document details how to configure, calibrate and use the Hanwell 4000 Series Current Clamp System.

Although this manual focusses on using 4000 Series Current Clamp sensors and the **RL4601 Transmitter Unit** for use with Hanwell EMS, Version 1.0.9 and above, information is also provided, in **Appendix 1**, for the use of the Current Clamp System with Synergy. Additionally, information specific to using the Current Clamp System with versions of Hanwell EMS prior to Version 1.0.9 is provided in **Appendices 2** and **3**.

1.1 Pre-requisites

You will need the following to enable communication between EMS or Synergy and the RL4106 Transmitter Unit:

- A USB A/Mini B lead (Code: **Y055**).
- **EMS** or **Synergy** software installed on a PC/Server.
- **EMS Remote Management Tools / Synergy Management Tools**
  Needed whether the Current Clamp System can be physically connected to the EMS host PC/Server or if EMS is installed on a Virtual Machine (VM) or Remote Server.

1.2 System Description

A Current Clamp System consists of:

- One or more **RL4601 Radio Transmitters**.
- One or more Current Clamp Sensors:
  - J134 Current Clamp – 50A
  - J139 Current Clamp – 100A
  - J135 Current Clamp – 5A
  - J091 Current Clamp – 30A, 60A and 120A

  The **RL4601 unit** supports up to three Current Clamps sensors, connected by **Y060** Connection Cable(s).

Using Current Clamps sensors is a very convenient method of measuring electrical current, as an absolute minimum of installation work is required.

The software can, optionally, present the data in kW/Hr/30minute units as if it had come from an electricity meter and estimate costs based on user entered tariffs. See: **Section 4 - Meter Tariffs**.

Note: A software patch, supplied with this Unit, will need to be applied to the **EMS Remote Management Tools** to enable examples of this Unit manufactured after January 2020 to work properly with either Synergy or EMS v1.0.9 and earlier.
Copies of the patch can be obtained from Customer Services.

Note: Whilst the Hanwell 4000 Series Current Clamp System is very useful for understanding patterns of usage, it **may not** provide the necessary accuracy if used as an electricity meter as estimates, rather than measurements, are made of the System Voltage and Power Factor.

If absolute accuracy is required, you should fit a sub-meter and use a Hanwell meter-logging device. However, in practice, the unique **Event Driven Mode** described below will ensure that very good results will be obtained in a typical installation.

- The **RL4601** Transmitter Unit is powered by a 3.6V AA Lithium cell (Replacement battery: Part No. **88706**).
- Battery voltages are recorded and transmitted and alarms can be generated remotely.

A red LED on the top of the Transmitter Unit illuminates if a fault condition exists on the Unit and signifies that the Unit should be Synchronised following rectification of the fault.

Note: If the Transmitter Unit has previously operated and collected data, this data should be Merged before Synchronising the Unit.

1.3 RL4601 Transmitter Unit Operation

Once configured, the RL4601 Transmitter Unit samples its associated Current Clamp sensors and then processes the data as outlined in the table below:

Instantaneous	At every defined Log/Transmit Interval (See: **Section 3.2.1 - Entering a Current Clamp System's Calibration Settings into EMS**) the Unit Logs/Transmits the value measured at that moment. • The sample interval is once every Log/Transmit interval. **Note:** Logging will only be enabled if the **Enable Logging** box is ticked in the **Current Clamp Configuration Tool** window. See Figure 19 below.
Average	At every defined Log/Transmit interval they Log/Transmit the average value measured over the previous Log/Transmit interval. • The sample interval is once/second.
Event	If enabled, in combination with either **Instantaneous** or **Average**, each sample will be compared with a programmed threshold. If the current is above this value, the unit will log/transmit every 8 seconds until - **Either:** The current drops below the threshold by a value greater than or equal to 90% of the threshold value. **Or:** The timeout period expires. **Note:** This is in addition to the data recorded by **Instantaneous** or **Average** Modes.

A combination of **Average** and **Event** Mode will provide a good compromise between battery life/accurate measurement of total power usage and the detection of transient events such as lift activation etc.

2 Hardware Installation

Before use, the following steps must be followed:

1. Fit the Current Clamp sensor(s) around the live feed(s) to be monitored.

   WARNING: NO DISCONNECTION OF CABLES SHOULD BE REQUIRED BUT, IF THIS INVOLVES WORKING NEAR EXPOSED HIGH VOLTAGE, E.G. IN DISTRIBUTION PANELS, THEN A QUALIFIED ELECTRICIAN MUST BE CONSULTED.

   Note: Remember, only the live cable should be enclosed by the clamp.

   ➢ If the feed is 3-phase, all clamps monitoring the feed should go to one 4000 Series Sensor Unit.

   * If you are dealing with single phase supplies, a number of 4000 Series Sensor Units can be used as convenient.
   * The software will allow the data from any device to be treated as either three unrelated feeds or as one 3-phase supply.

   ➢ For the **J091** Current Clamp sensor, set the switch on the Clamp to 30, 60 or 120A as appropriate.

   * Use the lowest suitable range and note the setting.

   Note: If the expected currents are < 3A then you should set the scale on the clamp to 30A, wrap the cable **n** times through the clamp and decrease the **Full Scale** value by **n** for that channel. The resolution is fixed at 50mA regardless of the number of turns.
   Generally, you should try to work above 10% of Full Scale to maintain accuracy.

2. Before connecting the RL4601 Transmitter Unit *in situ*, you should set it up via the supplied software and the **Y055** USB lead.

   ➢ The required connections to the Current Clamp sensor(s) are as follows:

Channel No.	+ve	-ve
1	Green	Black
2	Red	White
3	Yellow	Blue

Any unused pairs should be twisted together

Note: Even if no Current Clamp Sensors are attached to the RL4601 Transmitter Unit, spurious readings can still be generated by the Unit.

3 Setting up a Current Clamp System with EMS

3.1 Adding the Current Clamp System to EMS

Refer to the EMS Online User Guide for general details of how to add Sensor/Transmitter Units to EMS, in particular the following Sections:

http://www.help.emsprocloud.com/index.html?add-assign-sensors-to-a-zone.html

http://www.help.emsprocloud.com/index.html?hardware-installation.html

3.2 Configuring the Current Clamp System in EMS

To set up a Current Clamp System to work with EMS:

- Add the RL4601 Transmitter Unit and associated Current Clamp sensors to EMS as a '**Triple Current Clamp**' Sensor.
  See: http://www.help.emsprocloud.com/index.html?add-assign-sensors-to-a-zone.html.
- Enter the Current Clamp System's Calibration Settings into EMS (See **Section 3.2.1 - Entering a Current Clamp System's Calibration Settings into EMS**).
- Use the **EMS Remote Management Tools** to configure the Current Clamp system i.e.:
  - Load the RL4601 Transmitter Unit and associated Current Clamp sensors Calibration Settings into the RL4601 Transmitter Unit from EMS.
  - Synchronise the RL4601 Unit with EMS to download its **Physical Transmit ID** from EMS.

  (See **Section 3.2.2 - Configuring a Current Clamp System Using EMS Remote Management Tools**)

3.2.1 Entering a Current Clamp System's Calibration Settings into EMS

Note: If you are using a version of EMS prior to **Version 1.0.9 / 2.0.3 (Compliant)**, please refer to **APPENDIX 2 - Setting up an RL4601 Transmitter in Versions of EMS prior to Version 1.0.9/2.0.3 (Compliant)**

In EMS:

1. Click on the **Sites** radio button.
2. **Either**:

   Click on the **View Data** icon on the relevant Site's **Dashboard icon**. See Figure 1 below:

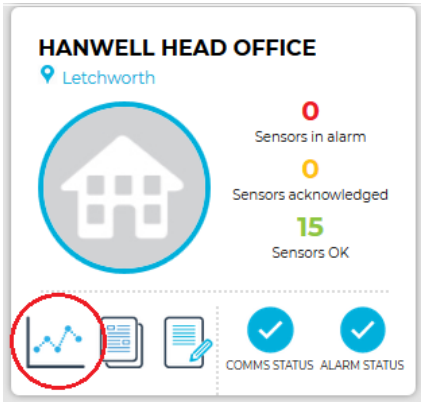


Figure 1

Or:

i. Select **Table View** from the **OVERVIEW** drop-down menu. See Figure 2 below:

Figure 2

* The **Sites Table View** window is displayed. See Figure 3 below:

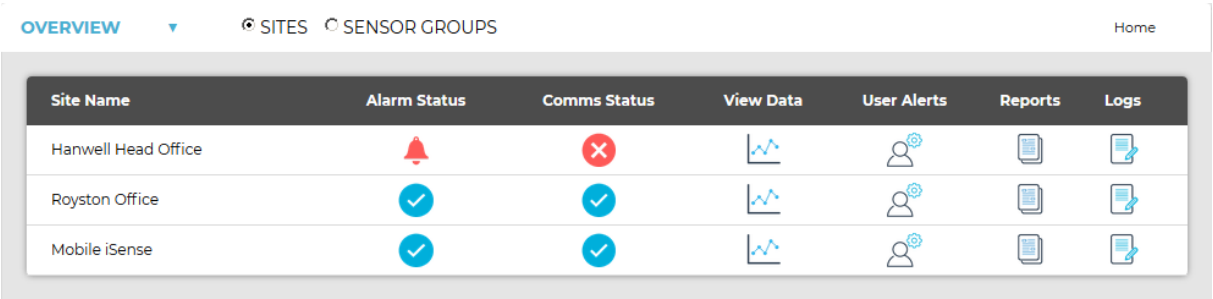


Figure 3

ii. On the **Sites Table View** window, click on the **View Data** icon associated with the Site you wish to view the Zones for. See Figure 4 below:

Figure 4

* The **Live View** window for the selected Site is displayed showing its associated **Zones** and their associated Sensors. See Figure 5 below:

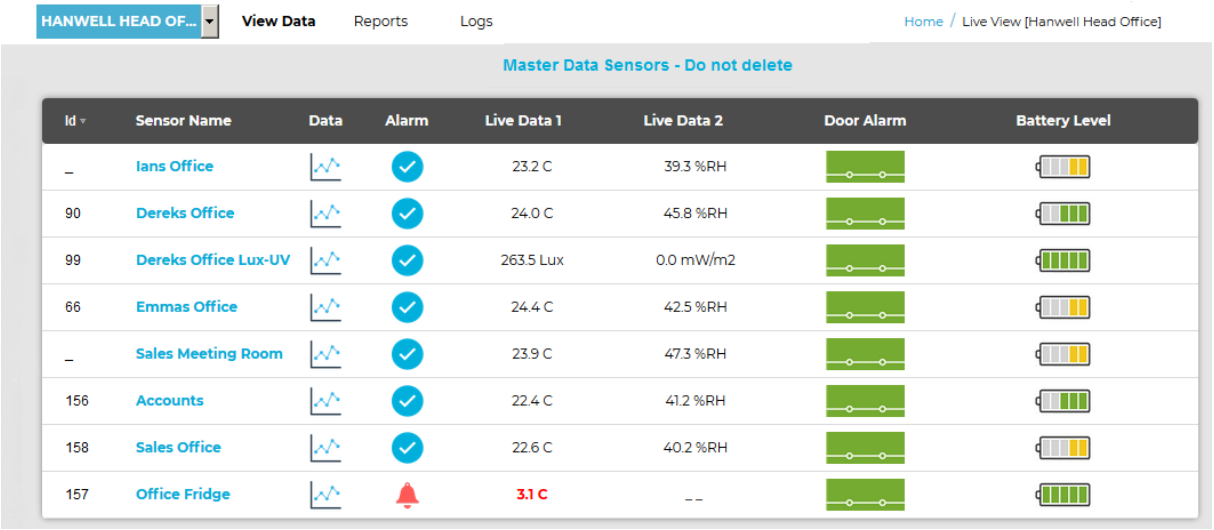


Figure 5

3. Select **Edit Mode** from the main **View Data** menu. See Figure 6 below:

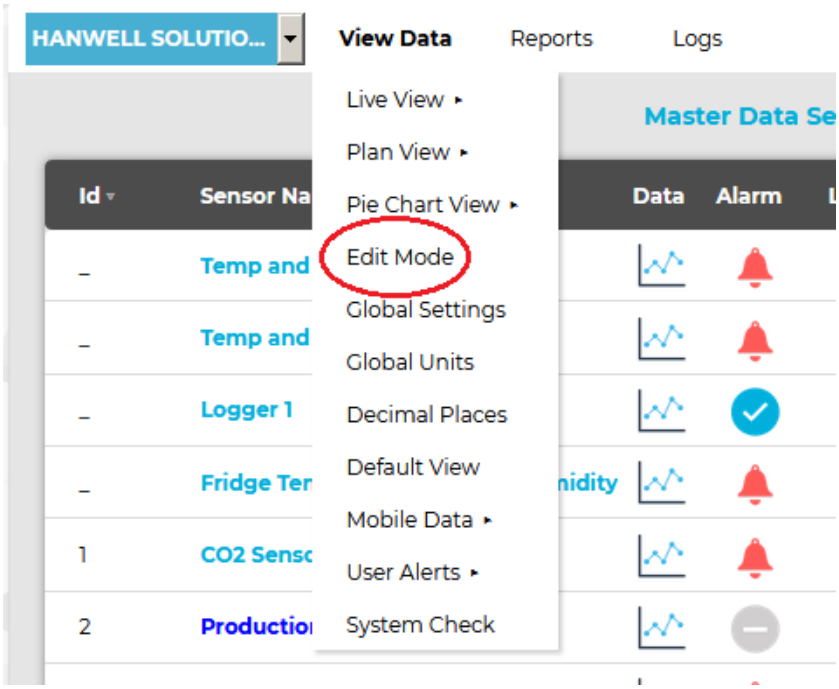


Figure 6

- The **Edit Mode** window is displayed. See Figure 7 below:

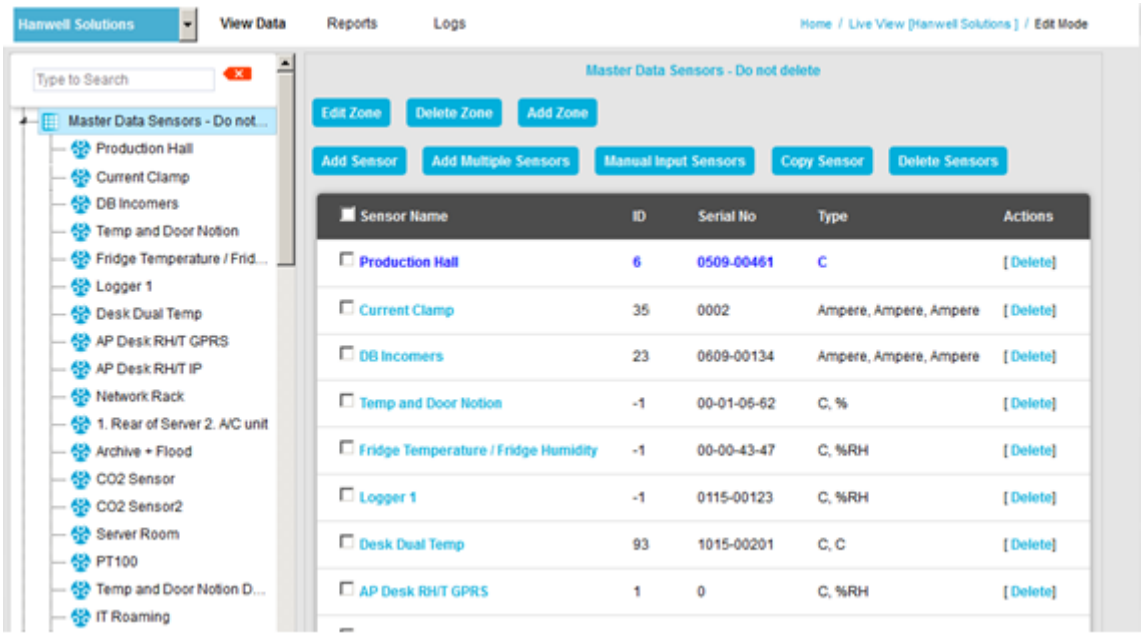


Figure 7

- By default, the **Edit Mode** window for the **Zone** at the top of the left-hand menu is displayed.
- To display another Zone's **Edit Mode** window, click on the entry for the required **Zone** in the left-hand menu. For an example. See Figure 8 below:

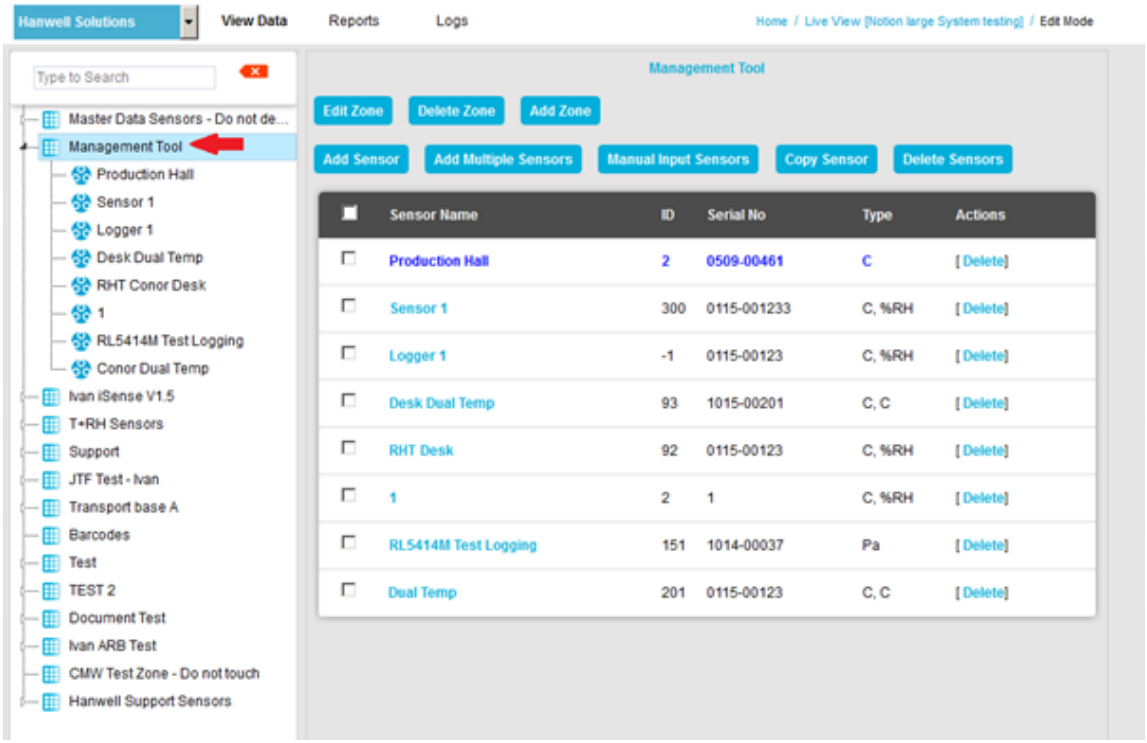


Figure 8

Note: **Edit Mode** is only available if you have the correct access **Permissions.**
If you do not have the correct access **Permissions**, the following message window will be displayed. See Figure 9 below:

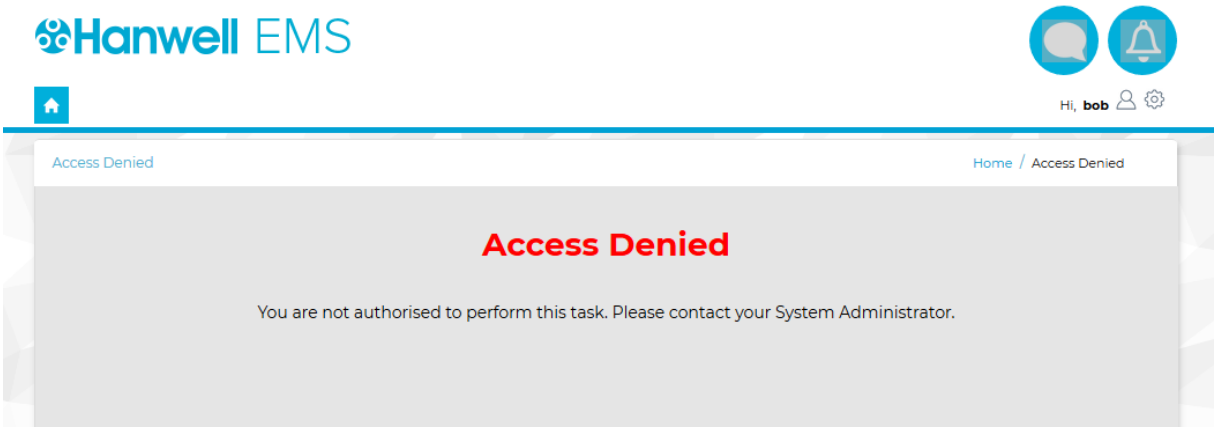


Figure 9

4. **Either**:

   i. In the left-hand list of the Zone's **Edit Mode** window, click on the small 'arrow' symbol to display a list of the Sensors associated with the Zone. See Figure 10 below:

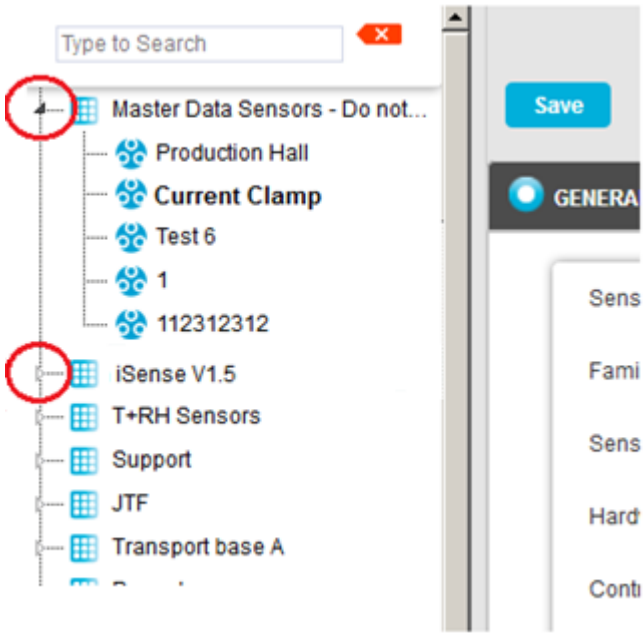


Figure 10

   ii. In the left-hand list, click on the required Sensor's icon. See Figure 11 below:

Figure 11

Or:

In table in the Zone's **Edit Mode** window, click on the required Sensor's name in the **Sensor Name** column. See Figure 12 below:

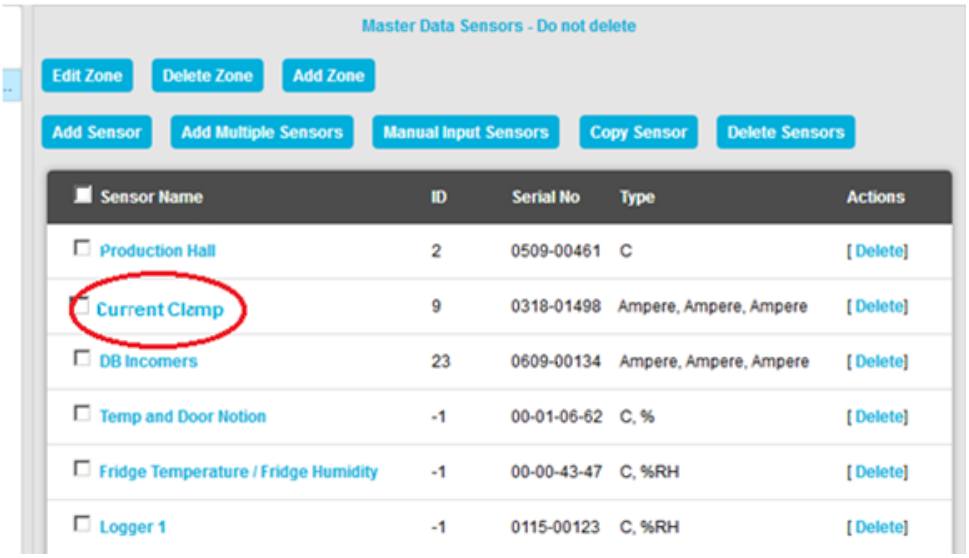


Figure 12

- The **Edit Mode** window for the selected Sensor is displayed. See Figure 13 below:

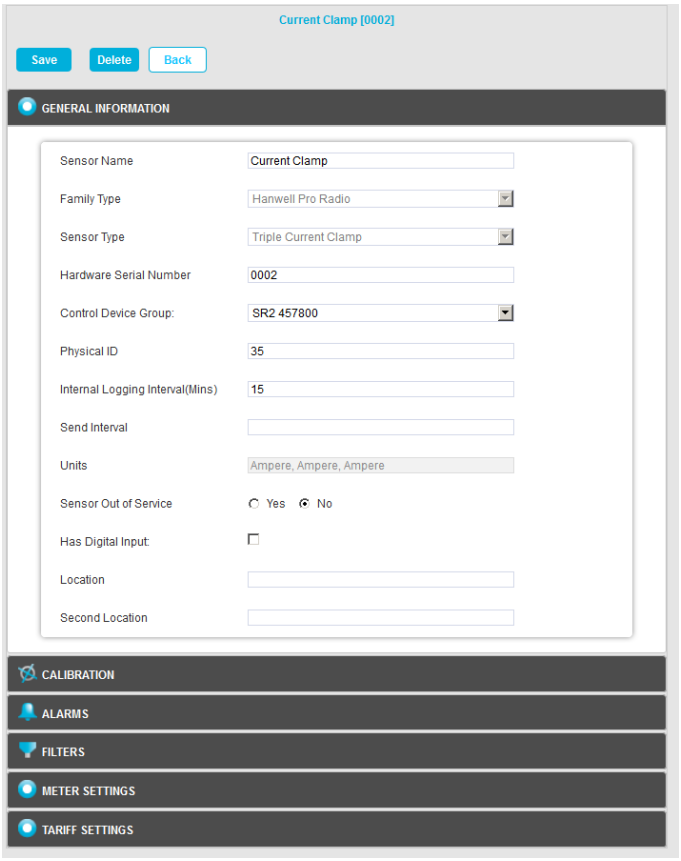


Figure 13

5. Click on the **Calibration** pane at the bottom of the **Edit Mode** window.

   ➢ The **Calibration** pane is displayed.

   * The three **Current** tabs represent each of the possible feeds that can be monitored by an RL4601 Transmitter Unit. See Figure 14 below:

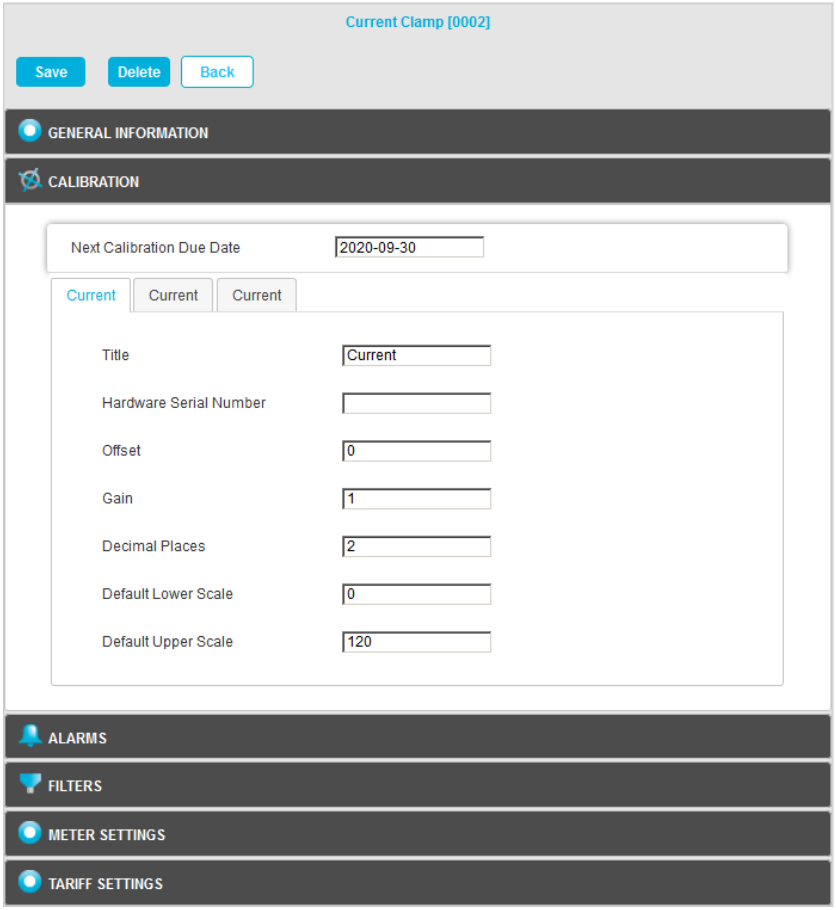


Figure 14

6. Leave the **Hardware Serial Number** fields in each tab blank as the Current Clamp probes do not have Serial Numbers.

7. Enter the following **Gain** values, according to the Current Value of the Current Clamp sensor monitoring the feed represented by the selected **Current** tab:

Current Value (Amps)	Gain
5	0.00180
30	0.01081
50	0.01801
60	0.02161
100	0.03602
120	0.04322

- For Current Clamps with different Current Values, the Gain can be calculated as follows:

  Amps x 0.000360201 = Gain

  e.g. 5 Amps x 0.000360201 = 0.00180

8. Once you are happy with the details, click on the **Save** button to save the Sensor's edited details.

   ➢ Click on the **Back** button to cancel editing the Sensor's details.

- The Sensor's details are updated and you are returned to the Zone's **Edit Mode** window.
- A green dialog box is displayed in the **Edit Mode** window confirming that the Sensor has been updated successfully. See Figure 15 below:

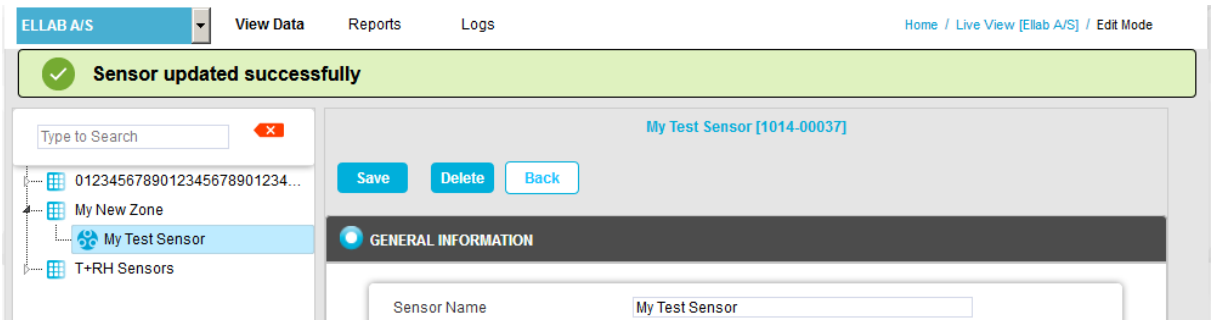


Figure 15

3.2.1.1 Setting Alarms

To set Alarm Parameters and Levels, refer to the following section in the EMS Online User Guide:

http://www.help.emsprocloud.com/index.html?levels.html

3.2.2 Configuring a Current Clamp System Using EMS Remote Management Tools

To configure a Current Clamp system:

1. Ensure that the RL4601 Transmitter Unit is connected to the PC/Server running the EMS application, via the supplied **Y055** USB lead.
2. Open the **EMS Remote Management Tools** application.

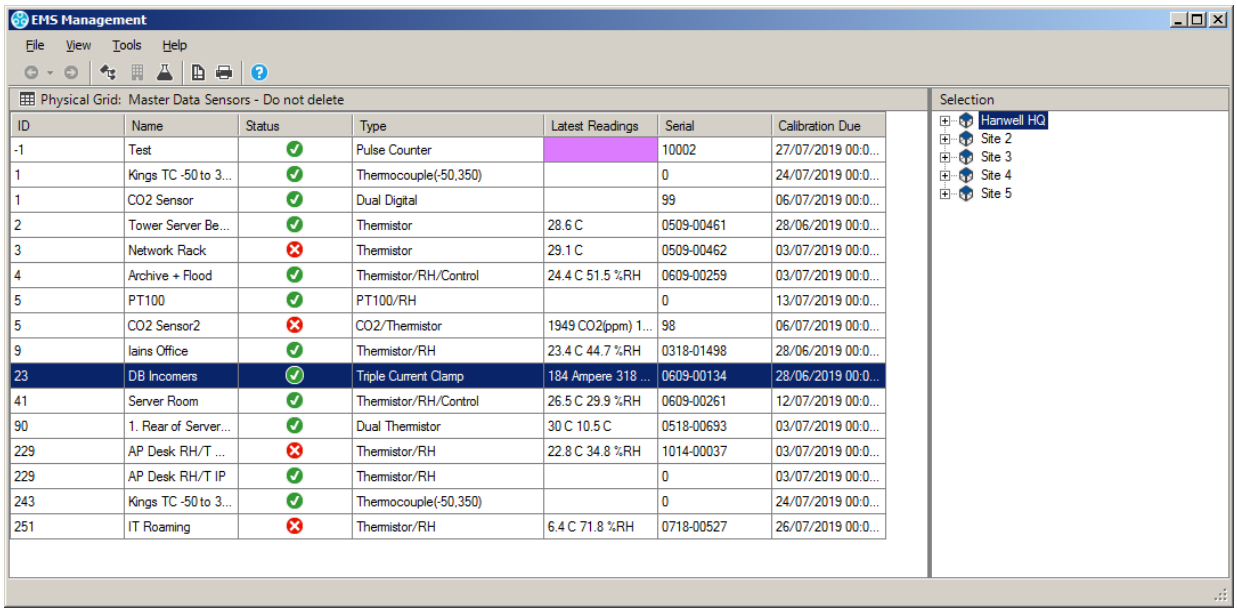
   ➢ The **EMS Remote Management Tools** provide an HTTP link to data in the EMS database, allowing an RL4601 Transmitter Unit, at a remote location, to be configured and associated with an existing EMS System.

   ➢ Once an RL4601 Transmitter Unit has been added to EMS via the Web Interface, the Remote Management Tools can be used to perform configuration tasks on the device, such as Synchronising and Calibrating.

Refer to the following sections in the EMS Online User Guide:

http://www.help.emsprocloud.com/index.html?ems-remote-management-tool.html

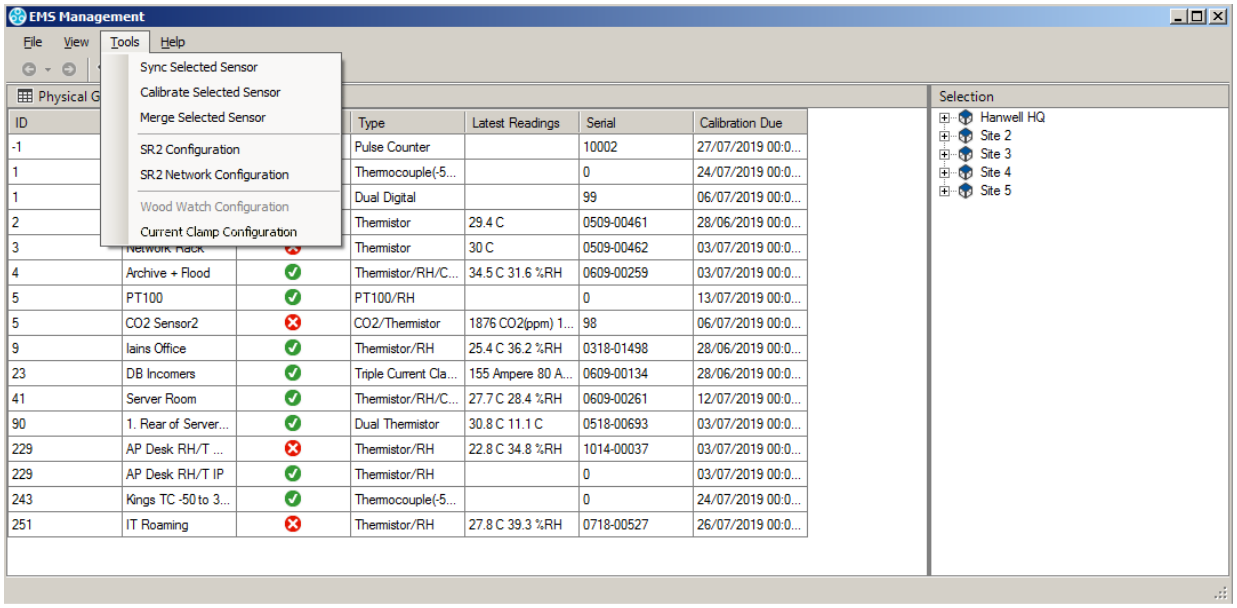
3. Select the required RL4601 Transmitter Unit from the EMS Remote Management Tools' **EMS Management** window.



ID	Name	Status	Type	Latest Readings	Serial	Calibration Due
-1	Test	✓	Pulse Counter		10002	27/07/2019 00:0...
1	Kings TC -50 to 3...	✓	Thermocouple(-50,350)		0	24/07/2019 00:0...
1	CO2 Sensor	✓	Dual Digital		99	06/07/2019 00:0...
2	Tower Server Be...	✓	Thermistor	28.6 C	0509-00461	28/06/2019 00:0...
3	Network Rack	✗	Thermistor	29.1 C	0509-00462	03/07/2019 00:0...
4	Archive + Flood	✓	Thermistor/RH/Control	24.4 C 51.5 %RH	0609-00259	03/07/2019 00:0...
5	PT100	✓	PT100/RH		0	13/07/2019 00:0...
5	CO2 Sensor2	✗	CO2/Thermistor	1949 CO2(ppm) 1...	98	06/07/2019 00:0...
9	Iains Office	✓	Thermistor/RH	23.4 C 44.7 %RH	0318-01498	28/06/2019 00:0...
23	DB Incomers	✓	Triple Current Clamp	184 Ampere 318 ...	0609-00134	28/06/2019 00:0...
41	Server Room	✓	Thermistor/RH/Control	26.5 C 29.9 %RH	0609-00261	12/07/2019 00:0...
90	1. Rear of Server...	✓	Dual Thermistor	30 C 10.5 C	0518-00693	03/07/2019 00:0...
229	AP Desk RH/T ...	✗	Thermistor/RH	22.8 C 34.8 %RH	1014-00037	03/07/2019 00:0...
229	AP Desk RH/T IP	✓	Thermistor/RH		0	03/07/2019 00:0...
243	Kings TC -50 to 3...	✓	Thermocouple(-50,350)		0	24/07/2019 00:0...
251	IT Roaming	✗	Thermistor/RH	6.4 C 71.8 %RH	0718-00527	26/07/2019 00:0...

Figure 16

4. Click on the **Tools** entry in the EMS Management window's Main Menu bar. See Figure 17 below.



ID		Type	Latest Readings	Serial	Calibration Due
-1		Pulse Counter		10002	27/07/2019 00:0...
1		Thermocouple(-5...		0	24/07/2019 00:0...
1		Dual Digital		99	06/07/2019 00:0...
2		Thermistor	29.4 C	0509-00461	28/06/2019 00:0...
3		Thermistor	30 C	0509-00462	03/07/2019 00:0...
4	Archive + Flood	Thermistor/RH/C...	34.5 C 31.6 %RH	0609-00259	03/07/2019 00:0...
5	PT100	PT100/RH		0	13/07/2019 00:0...
5	CO2 Sensor2	CO2/Thermistor	1876 CO2(ppm) 1...	98	06/07/2019 00:0...
9	Iains Office	Thermistor/RH	25.4 C 36.2 %RH	0318-01498	28/06/2019 00:0...
23	DB Incomers	Triple Current Cla...	155 Ampere 80 A...	0609-00134	28/06/2019 00:0...
41	Server Room	Thermistor/RH/C...	27.7 C 28.4 %RH	0609-00261	12/07/2019 00:0...
90	1. Rear of Server...	Dual Thermistor	30.8 C 11.1 C	0518-00693	03/07/2019 00:0...
229	AP Desk RH/T ...	Thermistor/RH	22.8 C 34.8 %RH	1014-00037	03/07/2019 00:0...
229	AP Desk RH/T IP	Thermistor/RH		0	03/07/2019 00:0...
243	Kings TC -50 to 3...	Thermocouple(-5...		0	24/07/2019 00:0...
251	IT Roaming	Thermistor/RH	27.8 C 39.3 %RH	0718-00527	26/07/2019 00:0...

Figure 17

5. Select **Calibrate Selected Sensor** from the **Tools** drop down menu. See Figure 17.

   ➢ The **EMS USB Sensor Calibration Vx.x** window is displayed and its fields populated. See Figure 18 below:

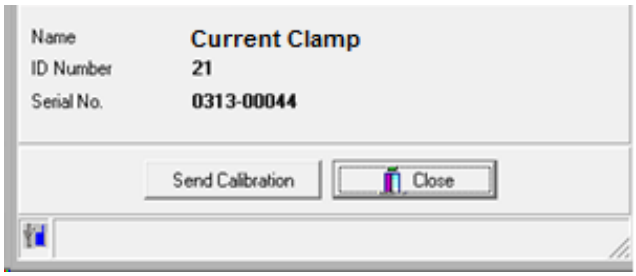


Figure 18

6. Click on the **Send Calibration** button and follow the instructions given until it reports that the Calibration is complete.

7. Select **Sync Selected Sensor** from the **Tools** drop down menu. See Figure 17.

   ➢ The **Current Clamp Configuration Tool** window is displayed. See Figure 19 below:

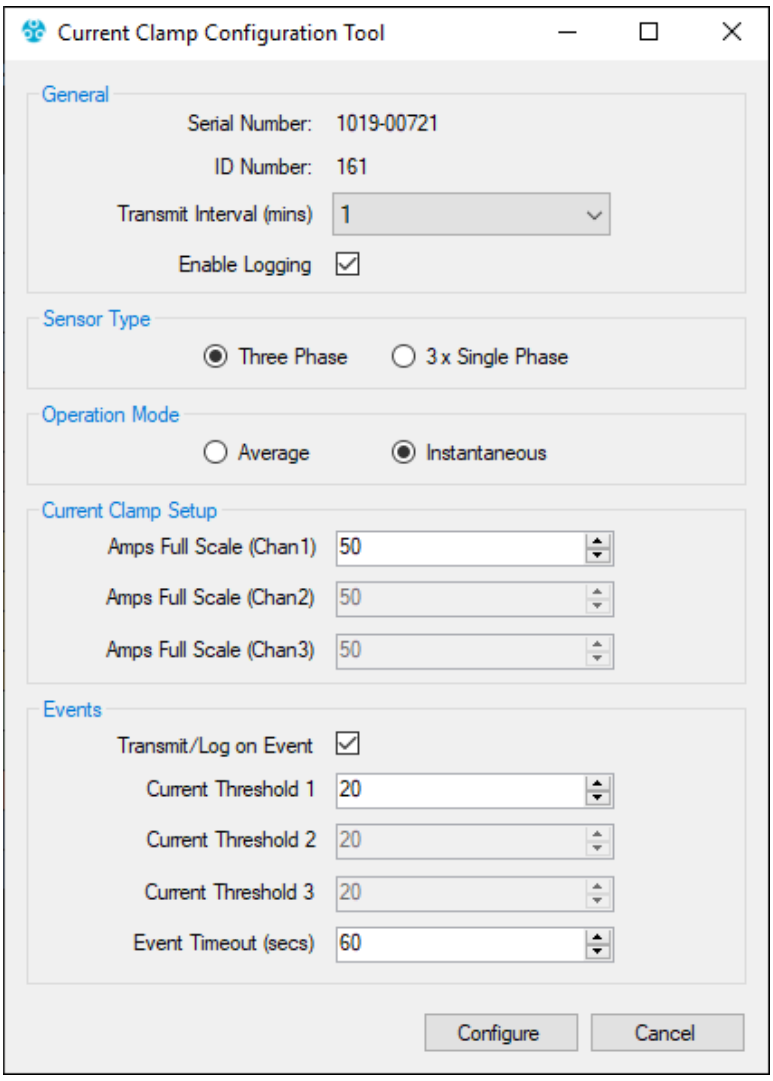


Figure 19

Note: The appearance of the above window may vary depending on the Operating System in use.

The Configuration Parameters available through this window are outlined below:

- **Transmit Interval (mins)**

  ➢ 1, 2, 3, 4, 5, 10 or 15 minutes

- **Sensor Type - Three Phase or 3 x Single Phase**

  The **ONLY** effect of this setting is related to the **Event Logging**.

If **Three Phase** is selected, one current threshold will be applied to all clamps. See Figure 20 below:	If **3 x Single Phase** is selected, then three individual thresholds can be entered. See Figure 21 below:

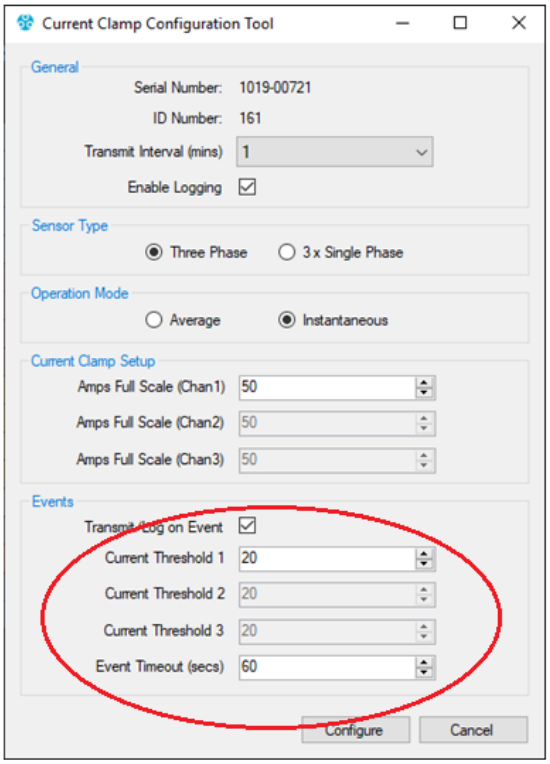


Figure 20

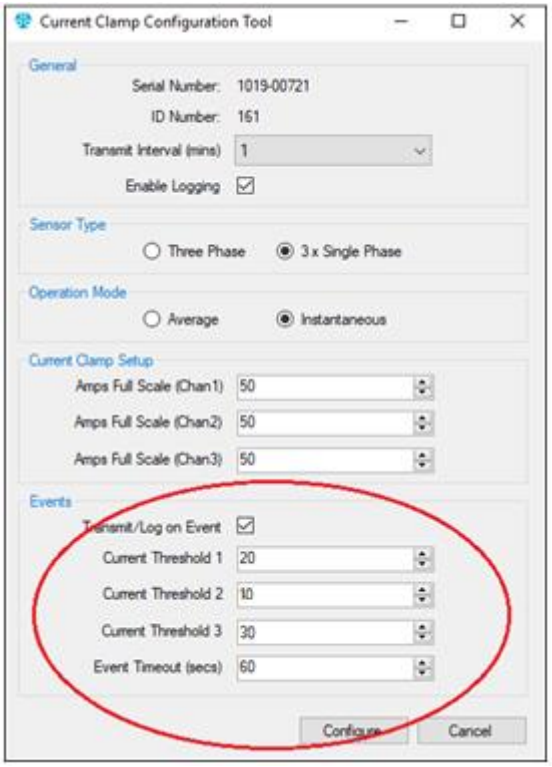


Figure 21

- **Operation Mode**

  Average or **Instantaneous**.

  ➢ **Average** is recommended.

- **Current Clamp Setup**

  ➢ The chosen **Amps Full Scale** value depends on the Current Clamp sensor being used e.g.: 5, 30 50, 60, 100 or 120 Amps.

  ➢ If a Channel is unused, then set this to 0.

- **Events**
  - ➢ **Transmit/Log on Event**

    React to high current levels.

    The Unit can also Log as it Transmits.

    Note: This feature must be enabled by ticking the **Transmit/Log on Event** box. If this box is ticked, the Unit will not Log at all and will only Transmit.

  - ➢ **Event Timeout (secs)**

    Maximum time in seconds that event is considered live.

    Note: Keep this value as small as reasonable to maximise battery life and minimize radio traffic.

- **Current Thresholds**

  As required.

  - ➢ Set to the same value as the Channel's full scale if not required on a particular Channel.

8. Enter or select the required values.
9. Click on **Configure** to synchronise the Current Clamp Unit.
   - ➢ If Logging is enabled, a message will appear warning you not to remove the battery otherwise data will be lost.

4 Meter Tariffs

Use **Meter Tariffs** to define billing strategies.

- A Tariff consists of one or more bands (time periods within the day) together with an associated unit cost.

  For example, a Tariff might consist of a Peak Rate during the day with a lower cost off-peak charge in the early hours. All 24 hours must be covered.

- Each band has a **Rate** associated with it.

  Meter Tariff Rates must be defined before creating **Meter Tariffs**.

4.1 Creating Meter Tariff Rates

Note: If you are using a version of EMS prior to Version 1.0.9 / 2.0.3, please refer to **APPENDIX 2 - Setting up an RL4601 Transmitter in Versions of EMS prior to Version 1.0.9/2.0.3 (Compliant)**

1. From the required Site's **Live View** window, select **Edit Mode** from the main **View Data** menu. See Figure 22 below:

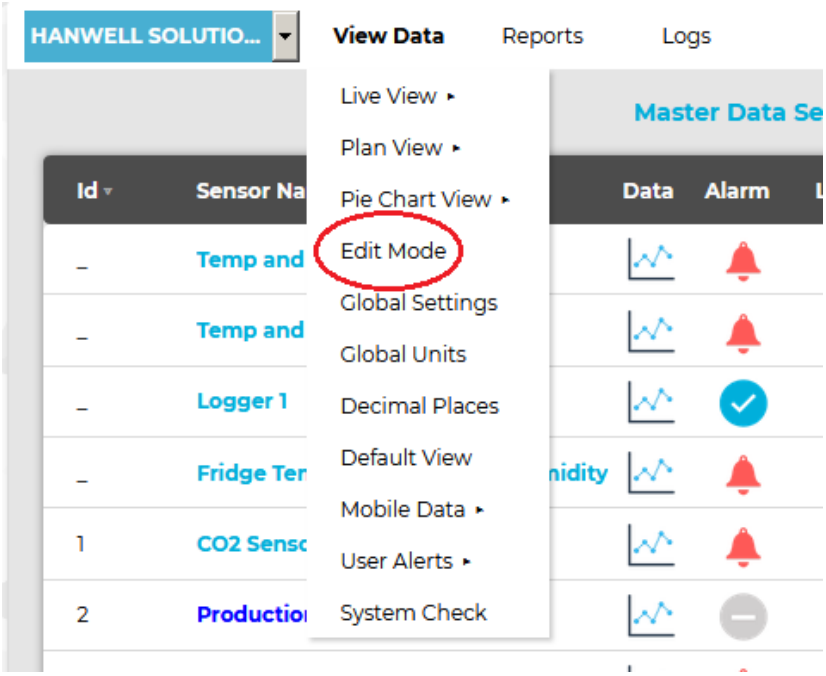


Figure 22

➢ The **Edit Mode** window is displayed. See Figure 23 below:

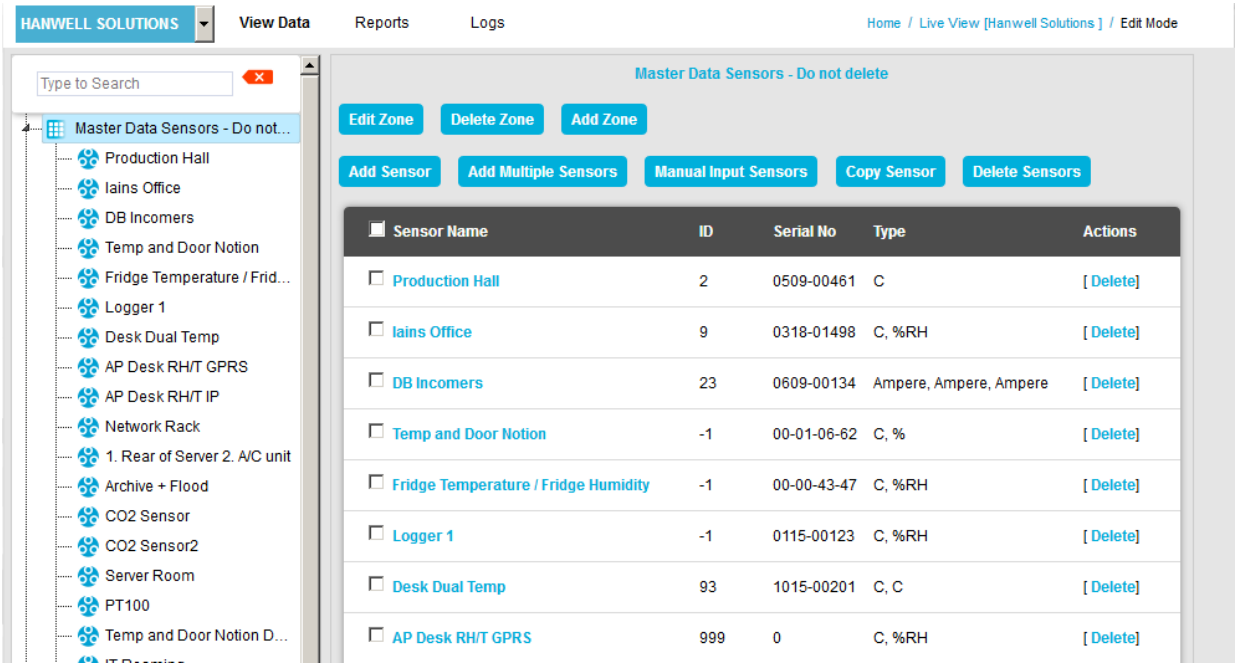


Figure 23

- By default, the **Sensor and Zone** editing/configuration window for the Zone at the top of the left-hand menu is displayed.
- To display another Zone's **Edit Mode** window, click on the entry for the required Zone in the left-hand menu. For an example, see Figure 24 below:

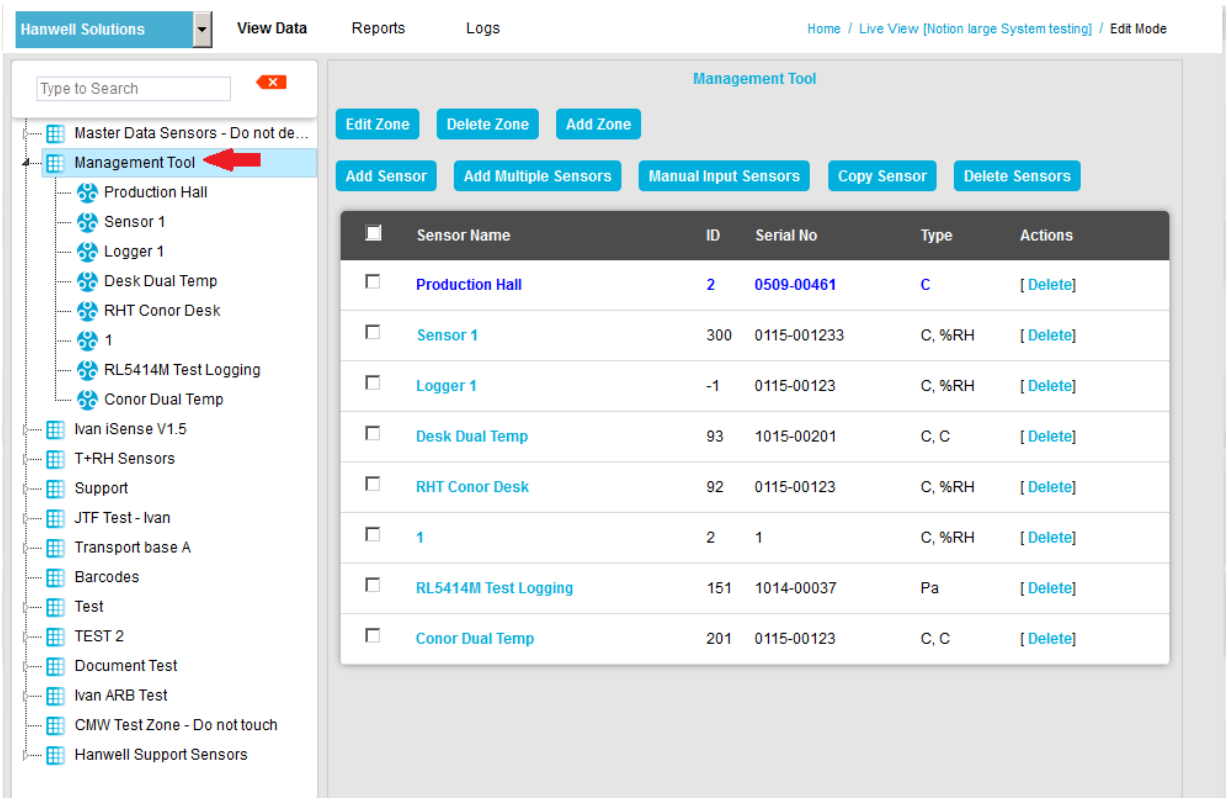


Figure 24

2. **Either**:

i. In the left-hand list of the Zone's **Edit Mode** window, click on the small 'arrow' symbol to display a list of the Sensors associated with the Zone. See Figure 25 below:

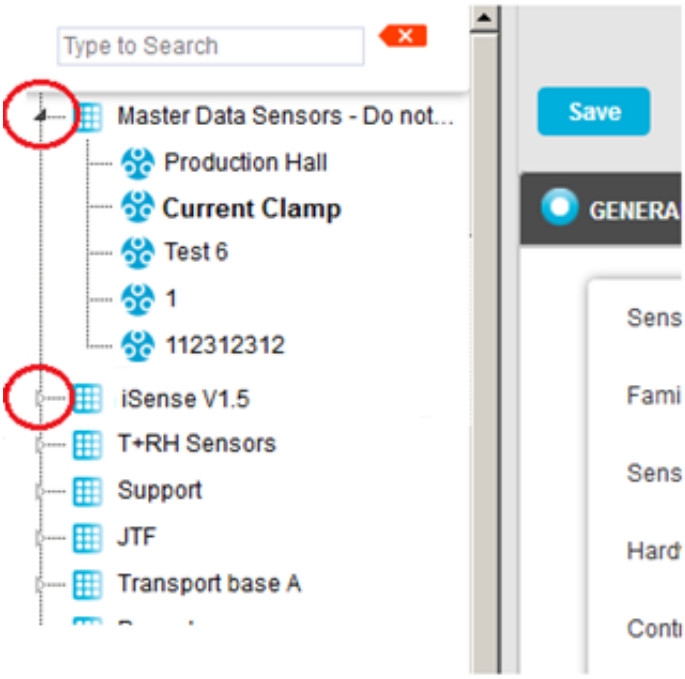


Figure 25

ii. In the left-hand list, click on the required Current Clamp Sensor's icon. See Figure 26 below:

Figure 26

Or:

In the table in the Zone's **Edit Mode** window, click on the required RL4601 Unit's name in the **Sensor Name** column. See Figure 27 below:

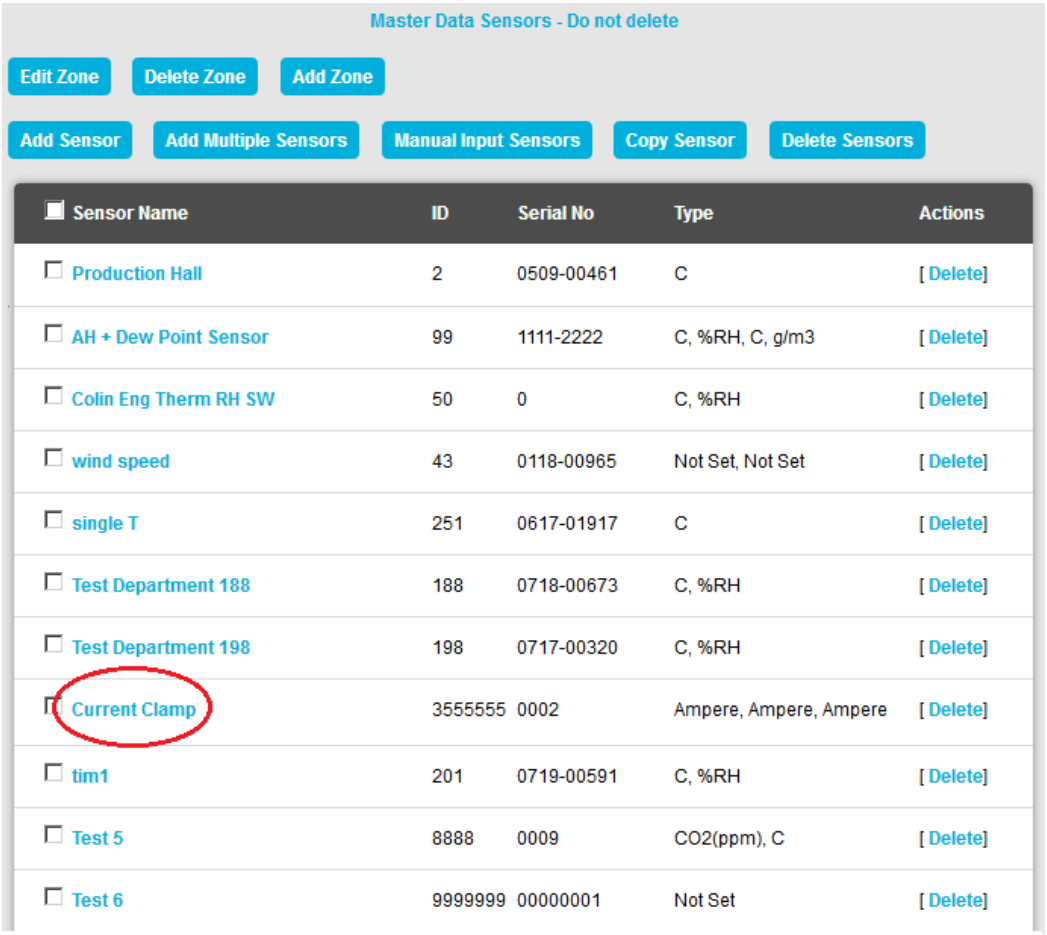


Figure 27

- The **Edit Mode** window for the selected Current Clamp Sensor is displayed. See Figure 28 below:

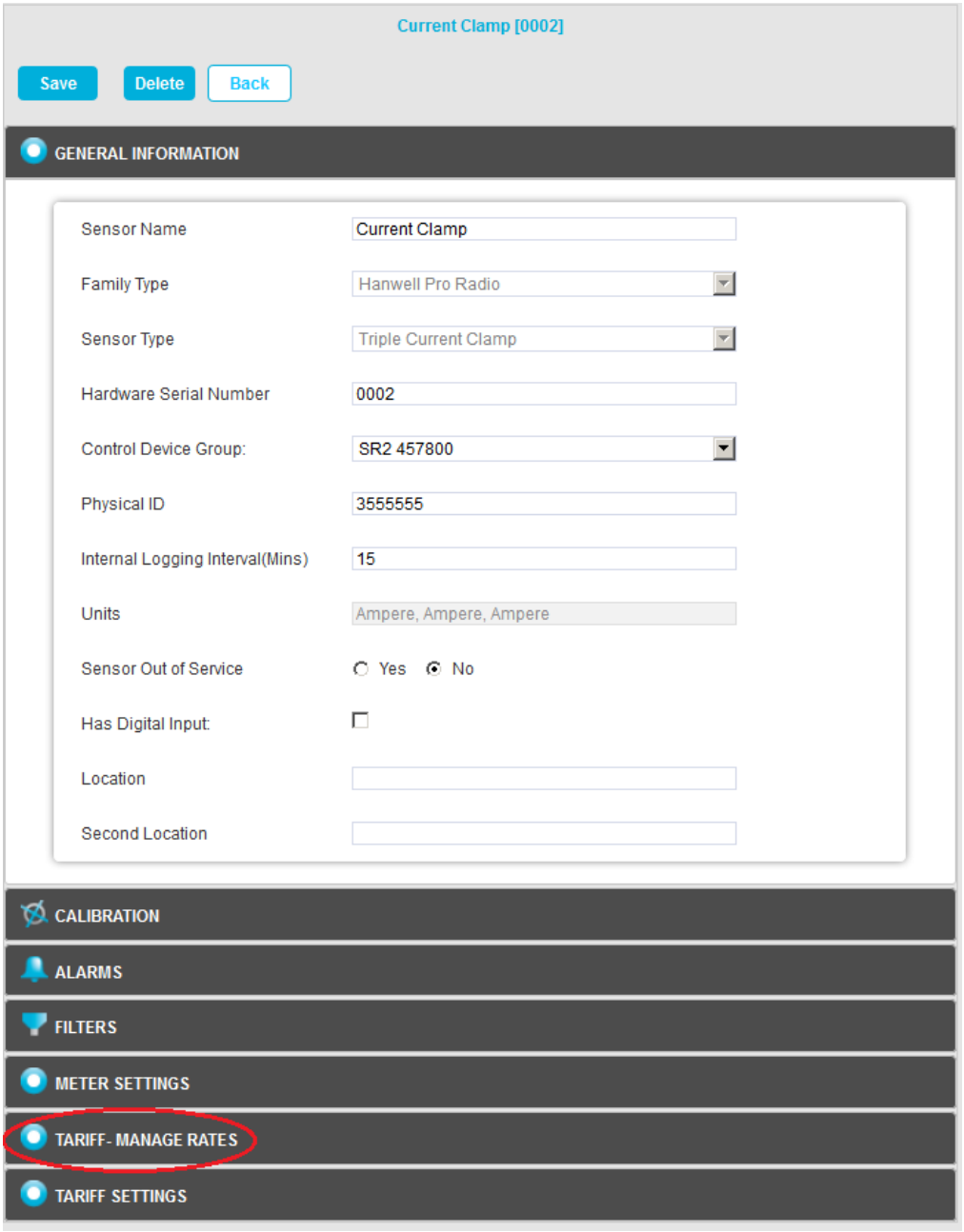


Figure 28

3. Click on the **TARIFF-MANAGE RATES** field. See Figure 28 above.

   ➢ The **TARIFF-MANAGE RATES** pane is displayed. See Figure 29 below:

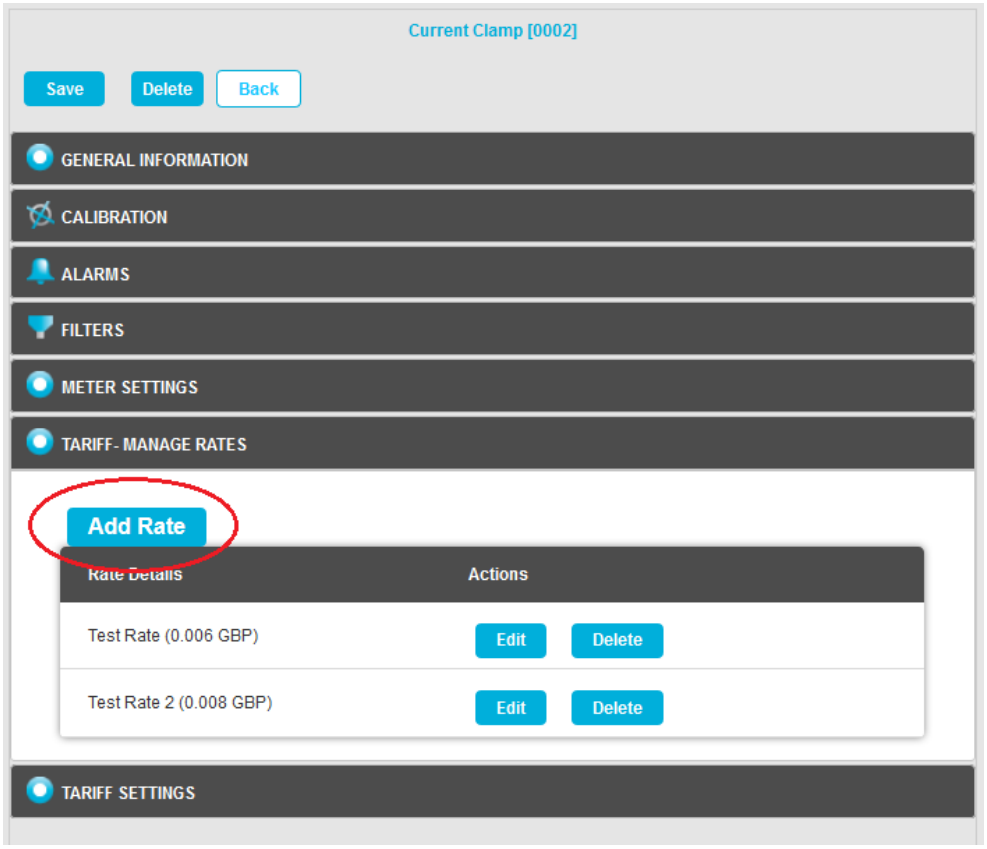


Figure 29

- The Tariff rates are displayed (in brackets) in the **Rate Details** column.

4. Click on the **Add Rate** button. See Figure 29 above.

- The **Manage Rate** window is displayed. See Figure 30 below:

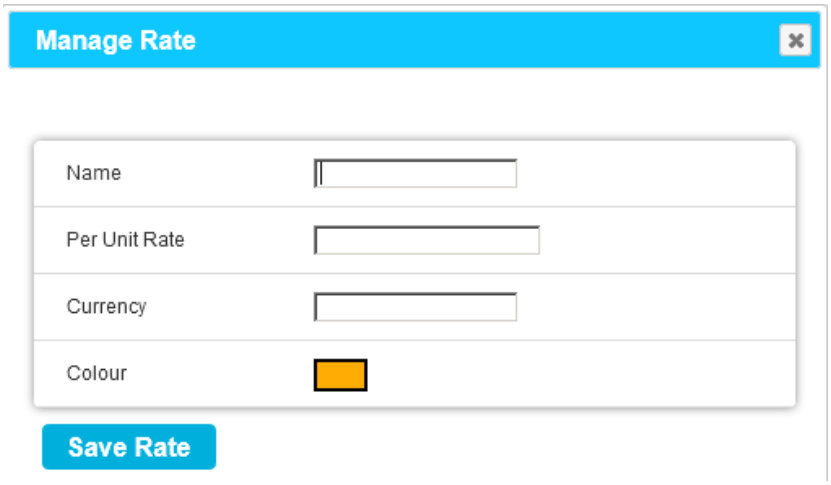


Figure 30

5. Enter the following details:

- An identifying **Name** for the Rate.
- The Tariff's **Per Unit Rate**.
- The **Currency** the Rate is to be charged in.

- A **Colour** from the palette to identify/highlight the particular Tariff Rate. See Figure 31 below:

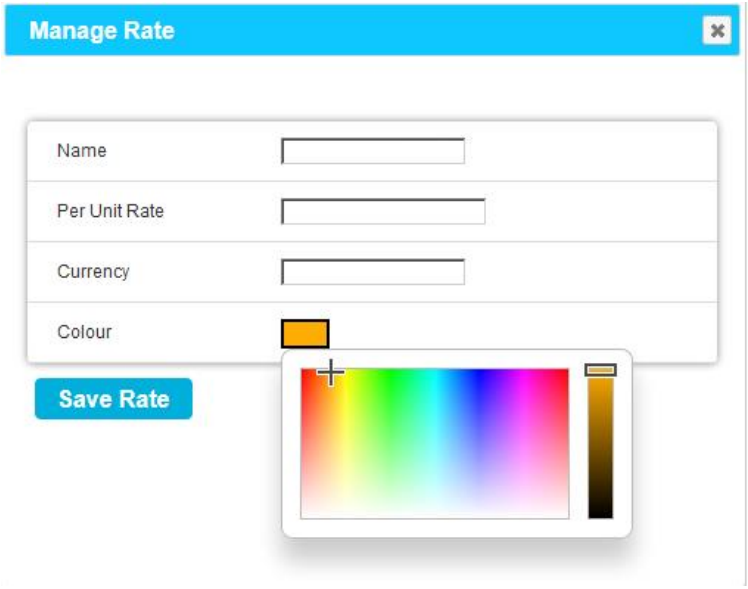


Figure 31

i. Click on the Colour block to display the Palette.

ii. Click on the required colour on the Palette to select it.

6. Click on **Save Rate**.

- You are returned to the **TARIFF-MANAGE RATES** window which now displays the new **Tariff Rate**.
- Repeat Steps 4 to 6 to add further Tariff Rates.

4.2 Editing a Meter Tariff Rate

1. In the **TARIFF-MANAGE RATES** window, click on the **Edit** button adjacent to the **Tariff Rate** you wish to edit. See Figure 32 below:

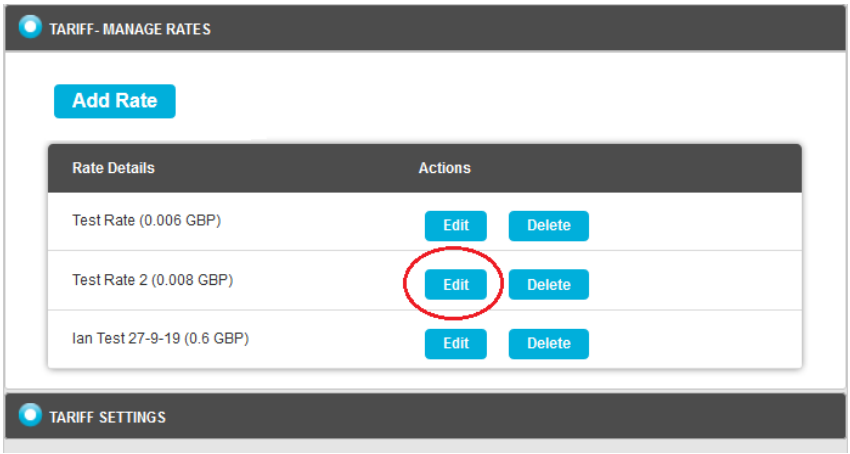


Figure 32

- The **Manage Rate** window for the selected **Tariff Rate** is displayed. See Figure 33

below:

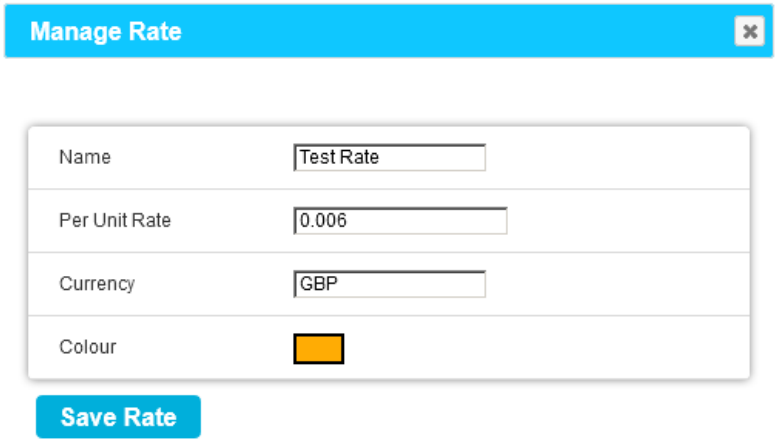


Figure 33

2. Edit the fields in the window as required (see **Step 5** above).
3. When all changes have been made, click on **Save Rate**.

- You are returned to the **TARIFF-MANAGE RATES** window which now displays the edited **Tariff Rate** details and a green message confirming the change(s). See Figure 34 below:

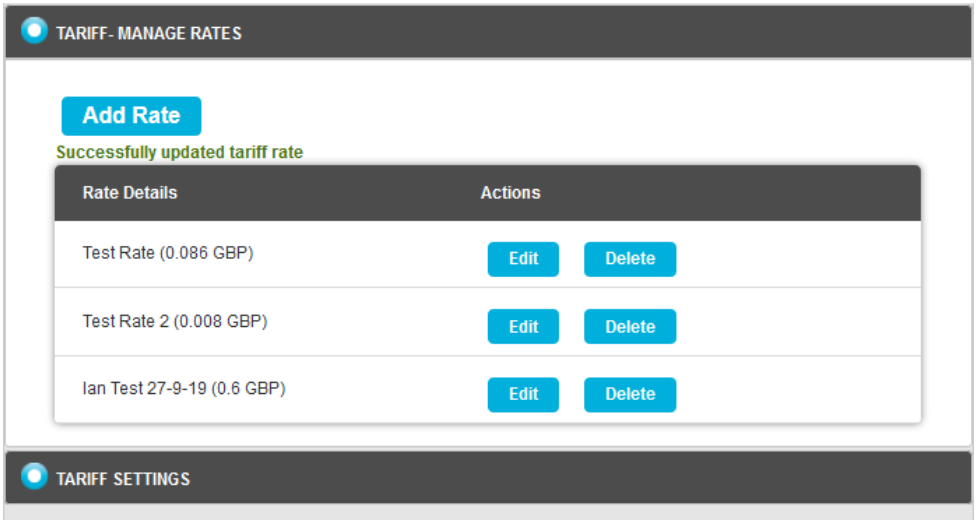


Figure 34

4.3 Deleting a Tariff Rate

Click on the **Delete** button adjacent to the **Tariff Rate** you wish to delete. See Figure 34 above.

- The selected Tariff Rate is deleted and you are returned to the **TARIFF-MANAGE RATES** window which no longer displays the deleted **Tariff Rate**. A green message confirms the deletion. See Figure 35 below:

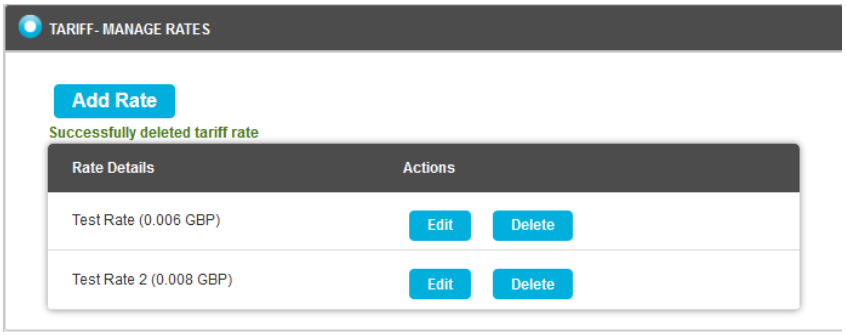


Figure 35

4.4 Defining a Meter Tariff

1. From the selected Current Clamp Sensor's **Edit Mode** window, click on the **TARIFF SETTINGS** field. See Figure 36 below:

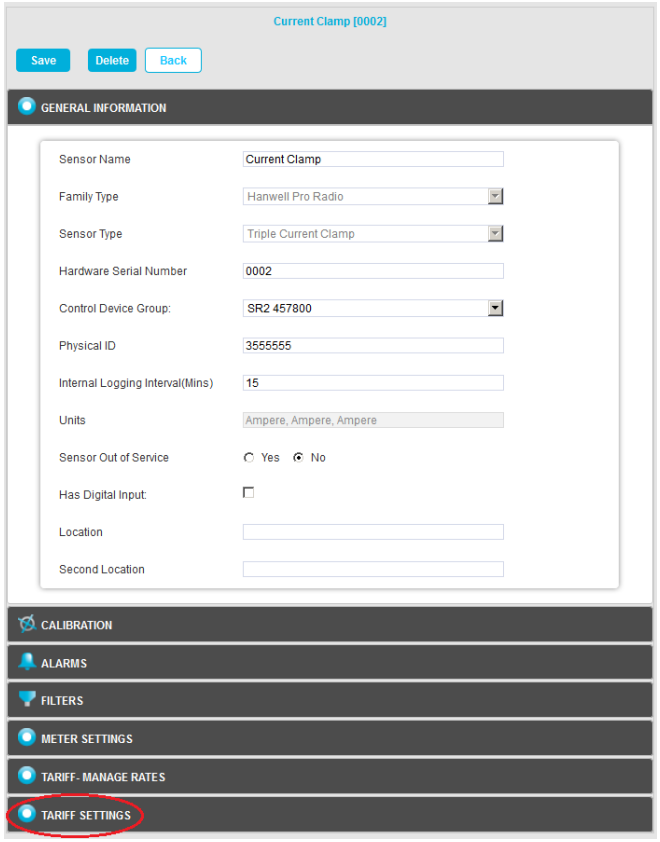


Figure 36

➢ The **TARIFF SETTINGS** pane is displayed. See Figure 37 below:

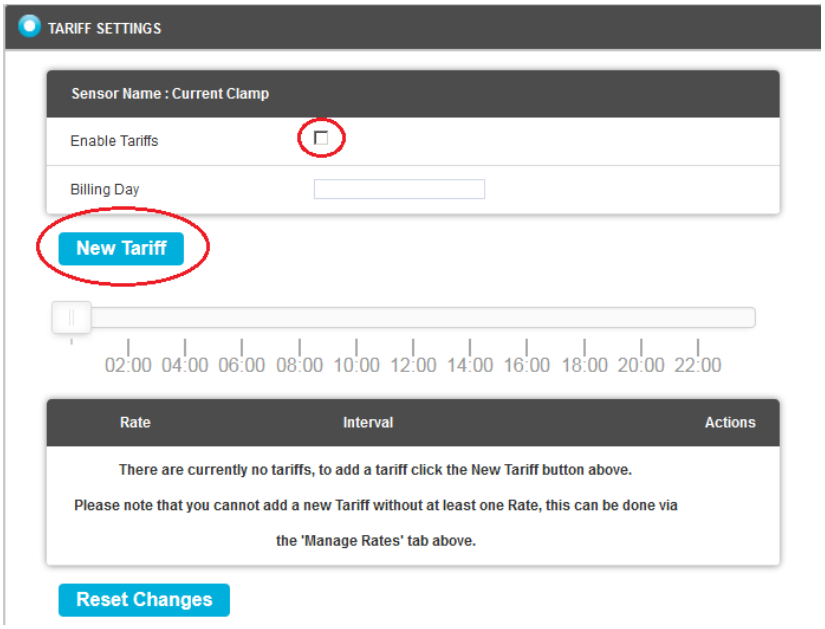


Figure 37

2. In the displayed pane:

   i. Check the **Enable Tariffs** box.

   ii. Enter a number (1 - 31) representing the day of the month that the Tariff will apply to into the **Billing Day** field.

   iii. Click on the **New Tariff** button.

   * See Figure 37 above.

➢ The **TARIFF SETTINGS** pane displays a **Test Rate** for the Tariff, highlighting the Slider bar with the Rate's defined colour (see **Colour Palette** information above). See Figure 38 below:

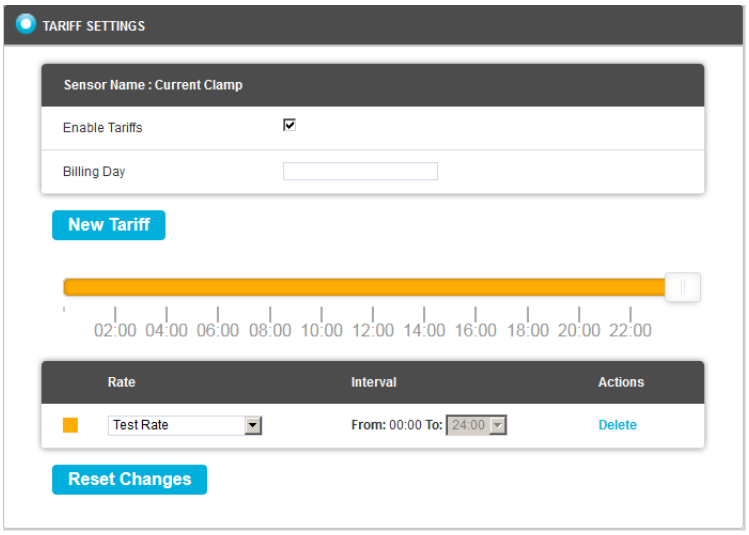


Figure 38

* By default, the first **Tariff Rate** defined in the **Manage Rates** window is

displayed.

Note: Initially, as only one **Tariff Rate** is associated with the **Tariff**, the **Interval** entry for the **Tariff Rate** will be inactive as the **Tariff Rate** will apply for the full 24 hour period.

➢ To allocate another **Tariff Rate** to the **Tariff**, click on the **Rate** drop-down menu and select one of the displayed Tariff Rates. See Figure 39 below:

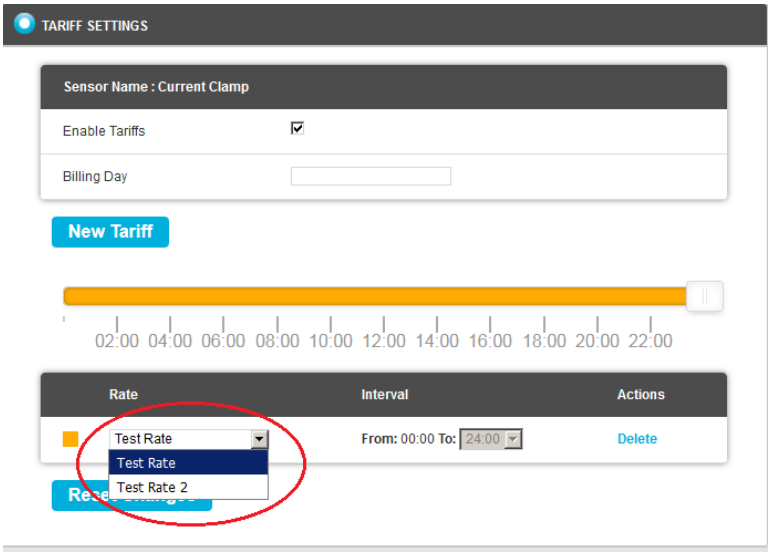


Figure 39

4.5 Defining Further Meter Tariffs

1. Click on the **New Tariff** button in the displayed **TARIFF SETTINGS** pane.

➢ The new **Tariff** is displayed in the **TARIFF SETTINGS** pane. See Figure 40 below:

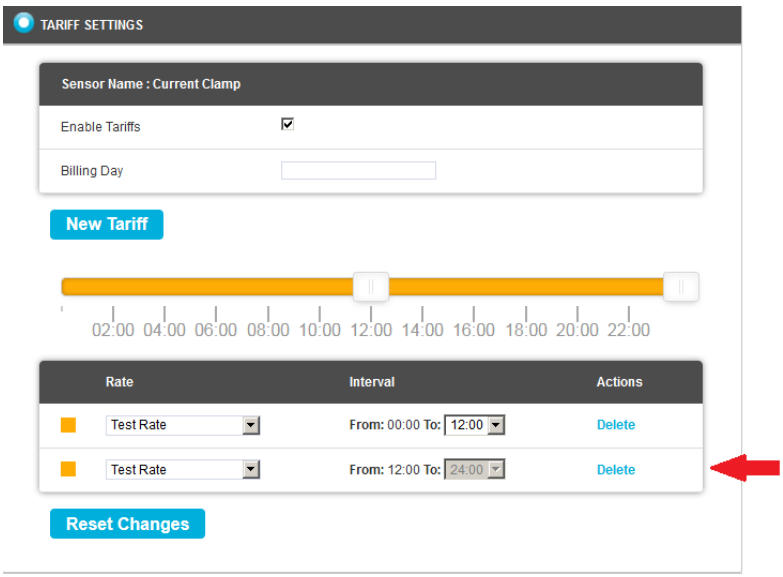


Figure 40

* By default, the first **Tariff Rate** defined in the **Manage Rates** window is

displayed for the new Tariff.

- To allocate another **Tariff Rate** to the **Tariff**, click on the new **Tariff's** Rate drop-down menu and select one of the displayed Tariff Rates. See Figure 39 above.

➢ The Slider bar shows the defined colours for each of the **Tariff Rates** allocated to the displayed **Tariffs**, indicating the time intervals over which they apply. See Figure 41 below:

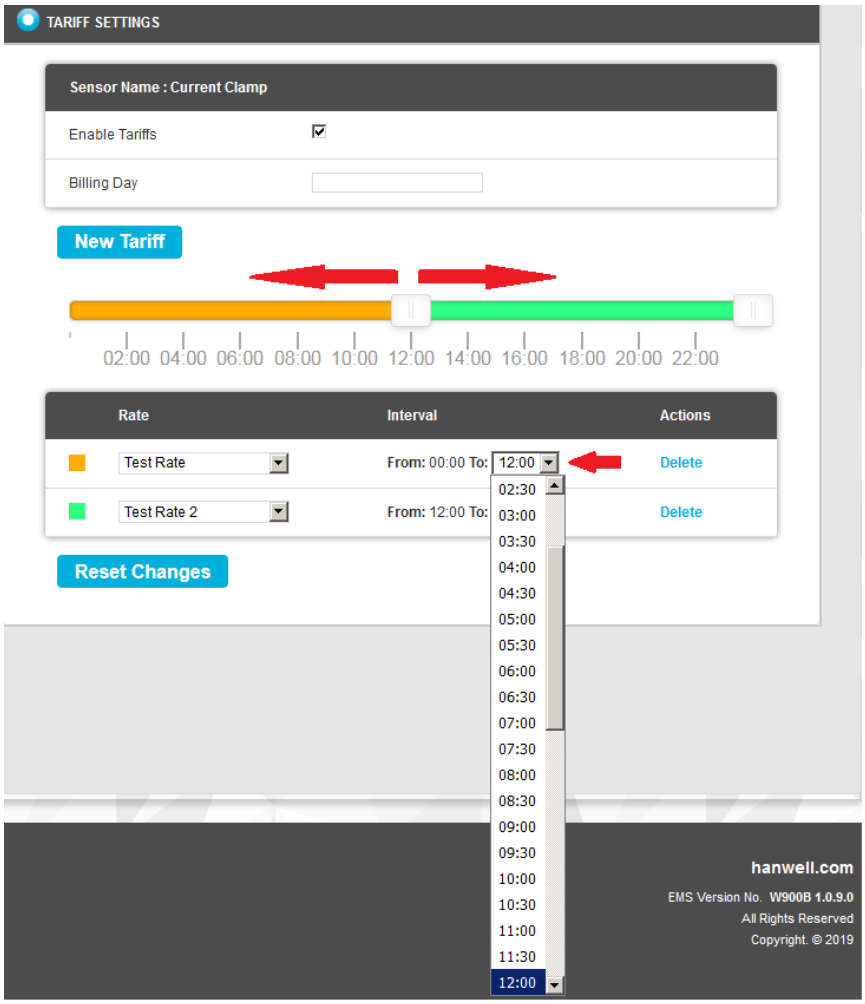


Figure 41

➢ By default each **Tariff** is allocated a 12 hour period of activity. These periods can be varied by -

Either:

Moving the Slider left or right to adjust the time each Tariff is active for. See Figure 41 above.

Or:

Selecting a time from the **Interval** drop-down list. See Figure 41 above.

Note: The **Interval** drop-down list will be inactive for a second added **Tariff** as the time it is active, in any 24 hour period, will be determined by the time period set for the first **Tariff**.

2. As with the first **Tariff**, select a **Tariff Rate** for it from its **Rate** drop-down list. See Figure 39 above.

➢ Further Tariffs are added and their **Tariff Rates** selected in the same way. See Figure 42 below:

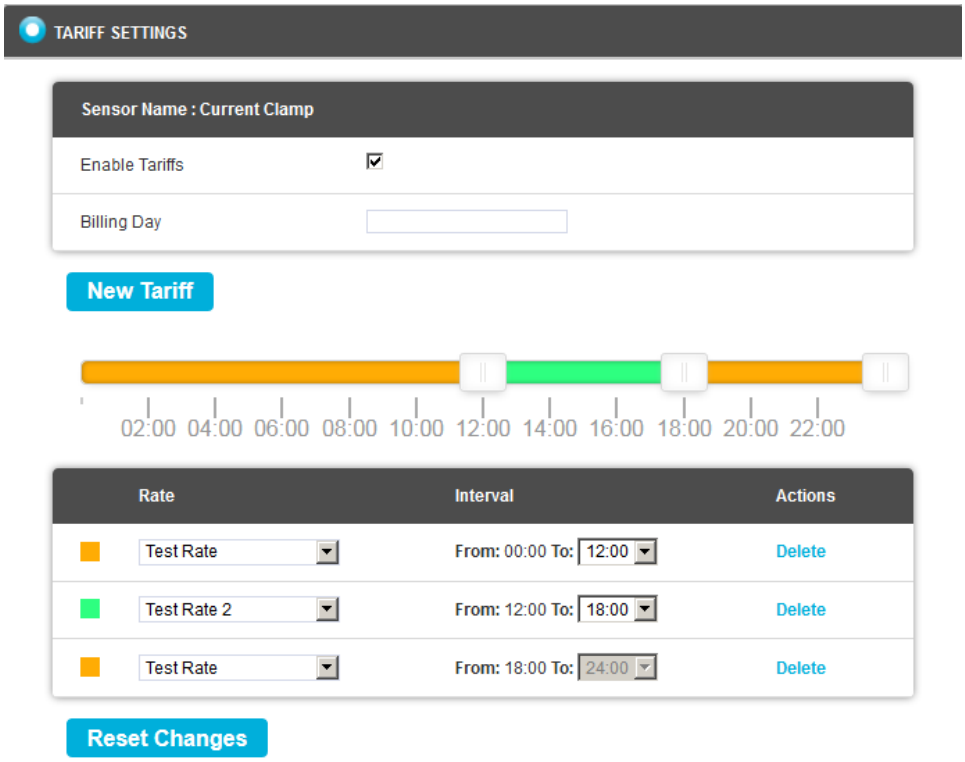


Figure 42

Note: The **Interval** drop-down list will be inactive for the final **Tariff** added as the time it is active, in any 24 hour period, is determined by the time periods set for the first and second Tariffs.

3. When all **Tariffs** and associated **Tariff Rates** have been defined, click on the **Save** button at the top of the **Edit Mode** window. See Figure 43 below:

Figure 43

➢ You are returned to the **Edit Mode** main window and a green message dialog is displayed, if the selected Current Clamp Sensor's details have been updated successfully. See Figure 44 below:

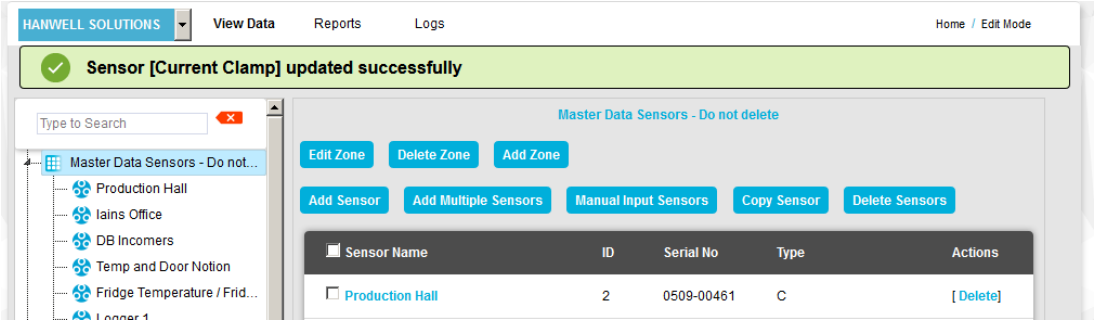


Figure 44

5 Viewing Data

5.1 Viewing Current Clamp Sensor Data

Viewing Sensor Data in EMS is covered by the following Section of the EMS Online User Guide:

http://www.help.emsprocloud.com/index.html?viewing-data2.html

5.2 Graphical Display of Current Clamp Sensor Data

To Display a Current Clamp Sensor's Data as a Graph:

1. Check the **SITES** radio button at the top of the Home page:

2. **Either:**

   From the **Graphical View**, click on the View live data icon in the required Site's field. See Figure 45 and Figure 46 below:

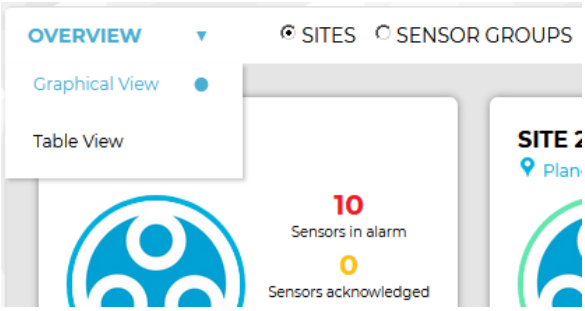


Figure 45

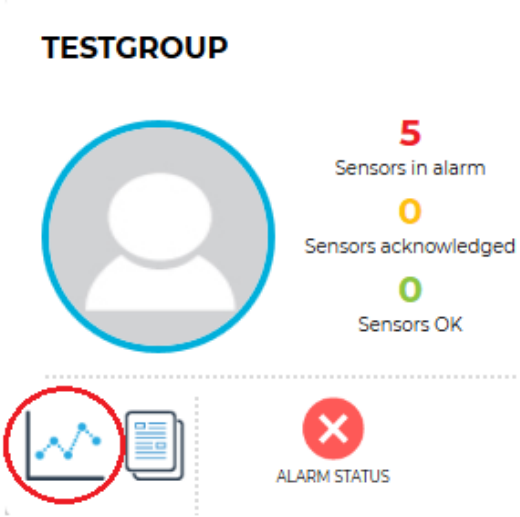


Figure 46

Or:

From the **Table View**, click on the icon adjacent to the required **Site** in the **View Data** column. See Figure 47 and Figure 48 below:

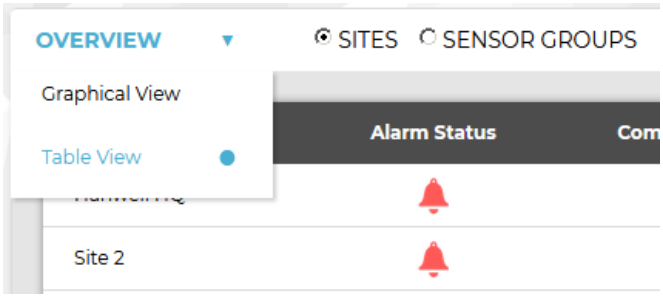


Figure 47

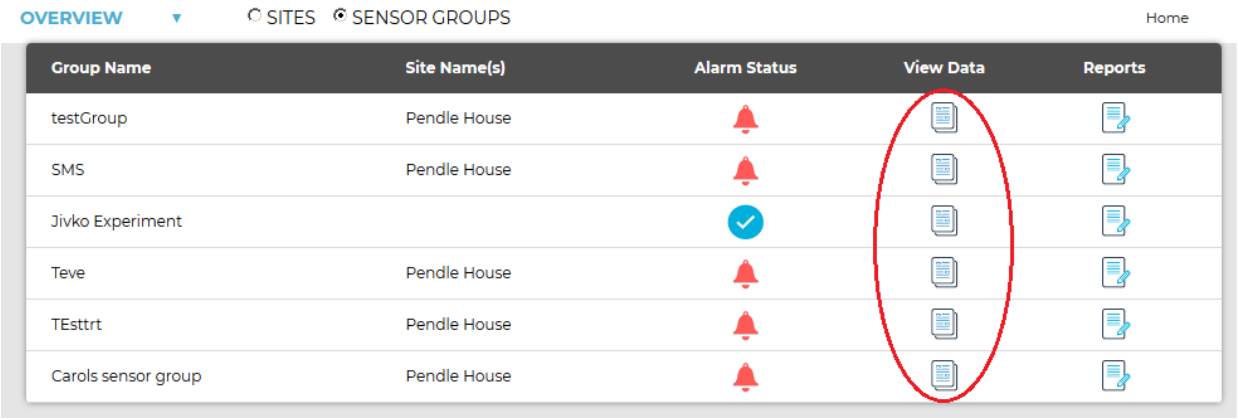


Figure 48

➢ The **Live View [Site name]** window is displayed showing a list of all sensors associated with the selected Site. See Figure 49 below:

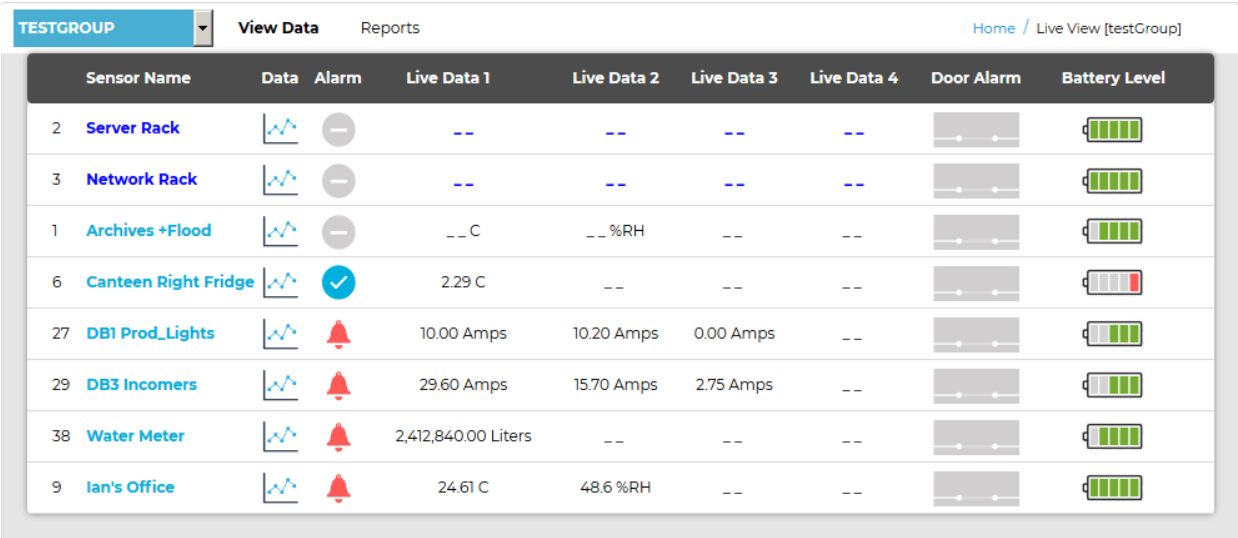


Figure 49

Note: You can display another Site's sensors in the **Live View** window by selecting the required Site from the drop-down list at the top left of the window. See Figure 50 below:

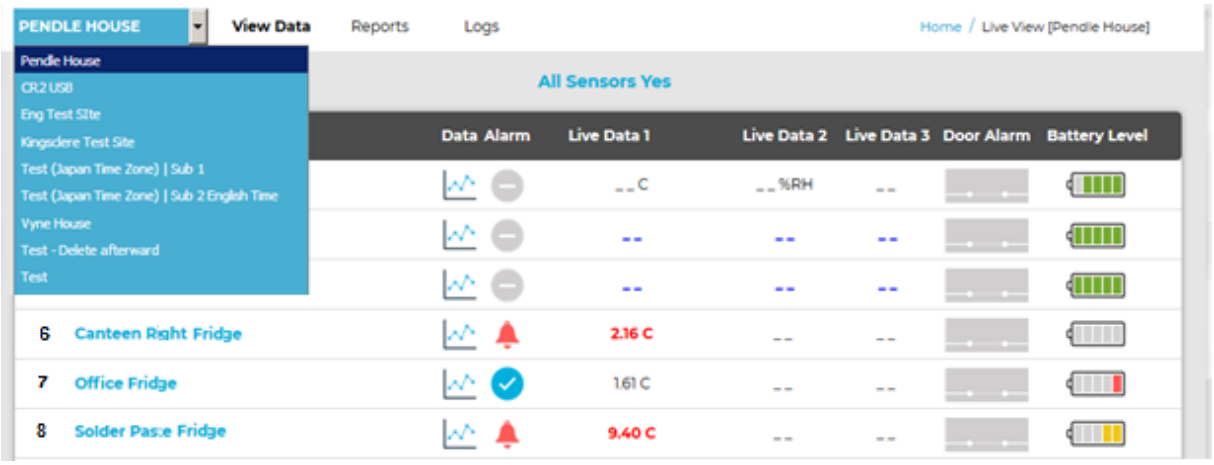


Figure 50

3. In the **Live View** window, select **View Data** from the top menu bar. See Figure 51 below:

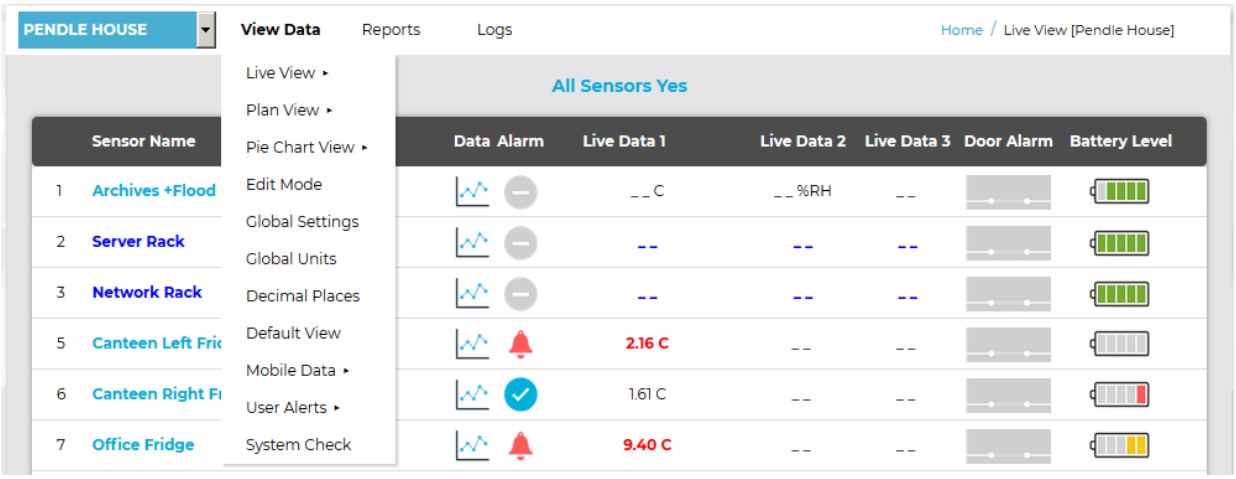


Figure 51

4. Click on **Live View** from the drop-down menu. See Figure 52 below.

   ➢ The **Live View** entry in the drop-down menu is expanded to display a list of all Zones associated with the selected Site.

   Note: By default, the **Live View** window displays a list of the Sensors for the Zone at the top of the drop-down list.

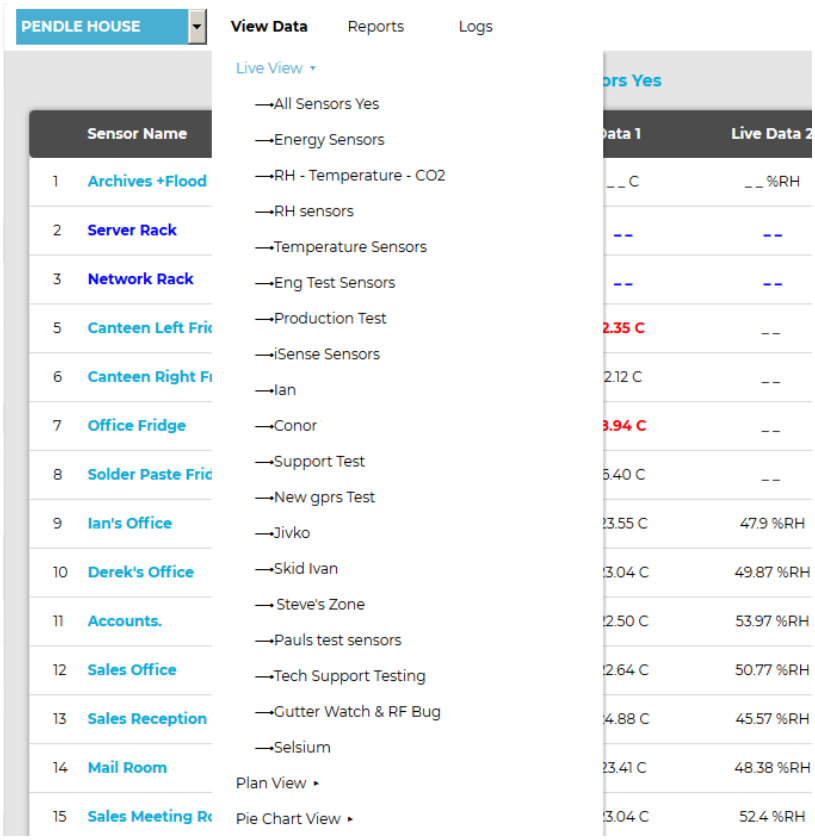


Figure 52

5. Click on the required Zone's name from the displayed list.

   ➢ A **Live View [Site name]** window is displayed, showing live data relating to the Sensors associated with the selected Zone. See Figure 53 below:

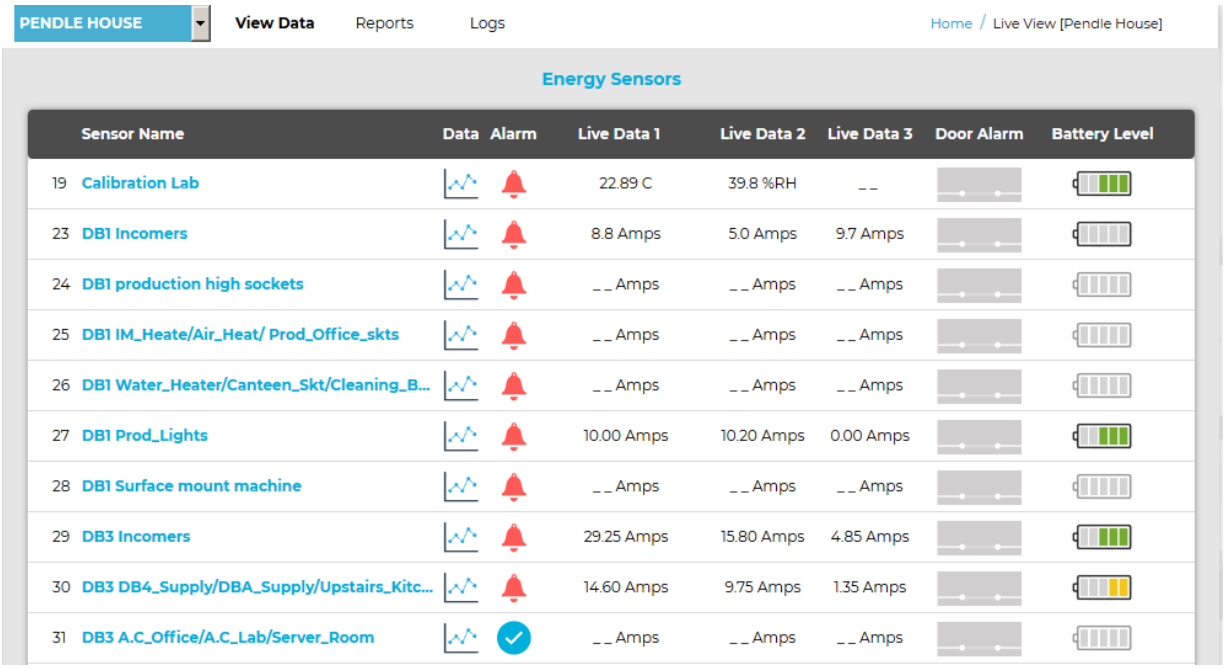


Figure 53

6. Click on the **View live** data icon on the required Sensor's row. See Figure 54 below:

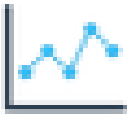


Figure 54

➢ The Current Clamp Sensor's data is displayed as a **Utilities Bar Chart** in the **Bar Chart [Sensor name]** window, as shown in Figure 55 below:

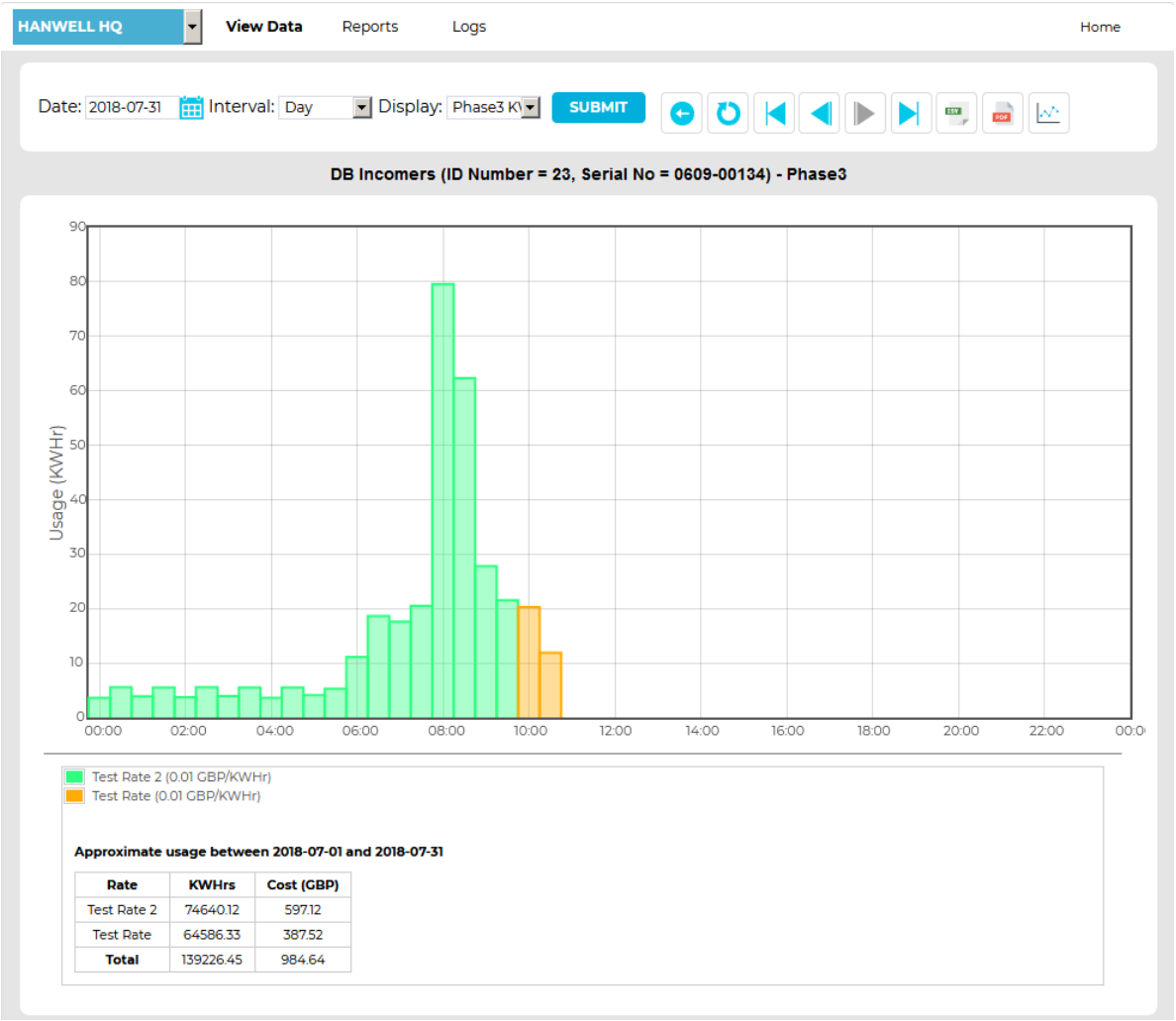


Figure 55

Note the different colours used to highlight the different Rates. See **Section 4 Meter Tariffs**.

5.3 Viewing Current Phase Data

It is possible to display separate bar charts for each phase of a 3-phase power system as follows:

1. From the **Display:** drop-down list, select the required Phase to display and the Units to use (KW/hr or GBP). See Figure 56 below:

   ➢ A graph of all three phases can also be displayed.

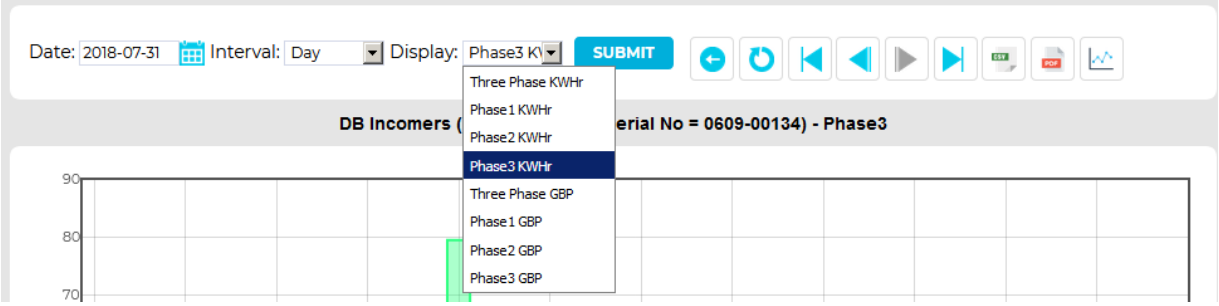


Figure 56

2. Click on **Submit**.

   ➢ The Bar Chart for the selected Phase is shown.

- The bar charts in Figure 57, Figure 58 and Figure 59 below show examples of the separate displays for each phase of a of a 3-phase supply.

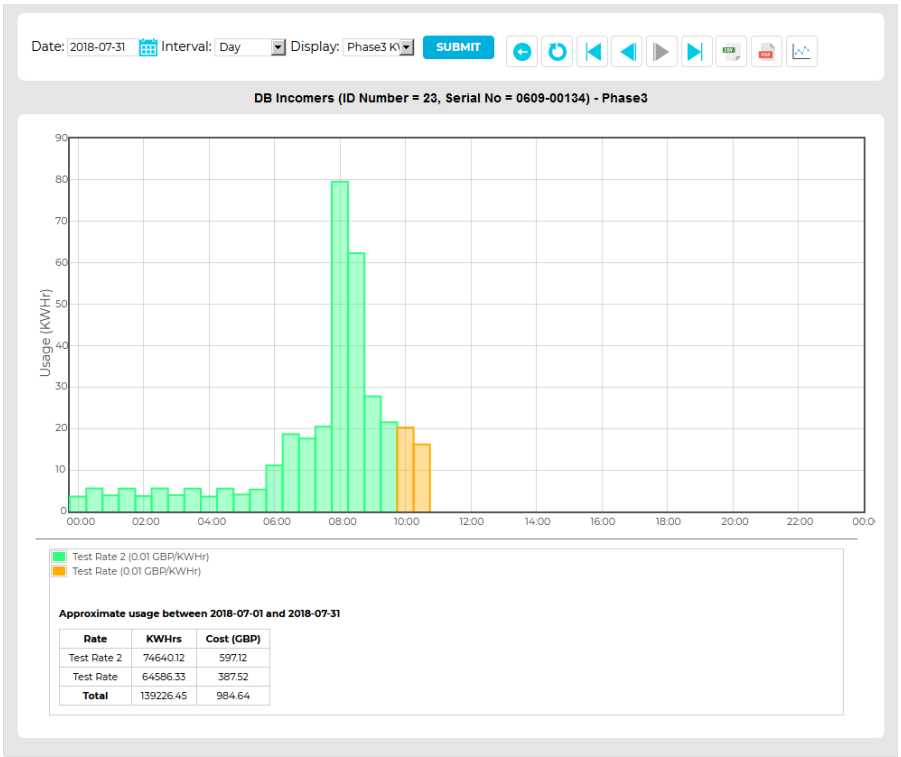


Figure 57

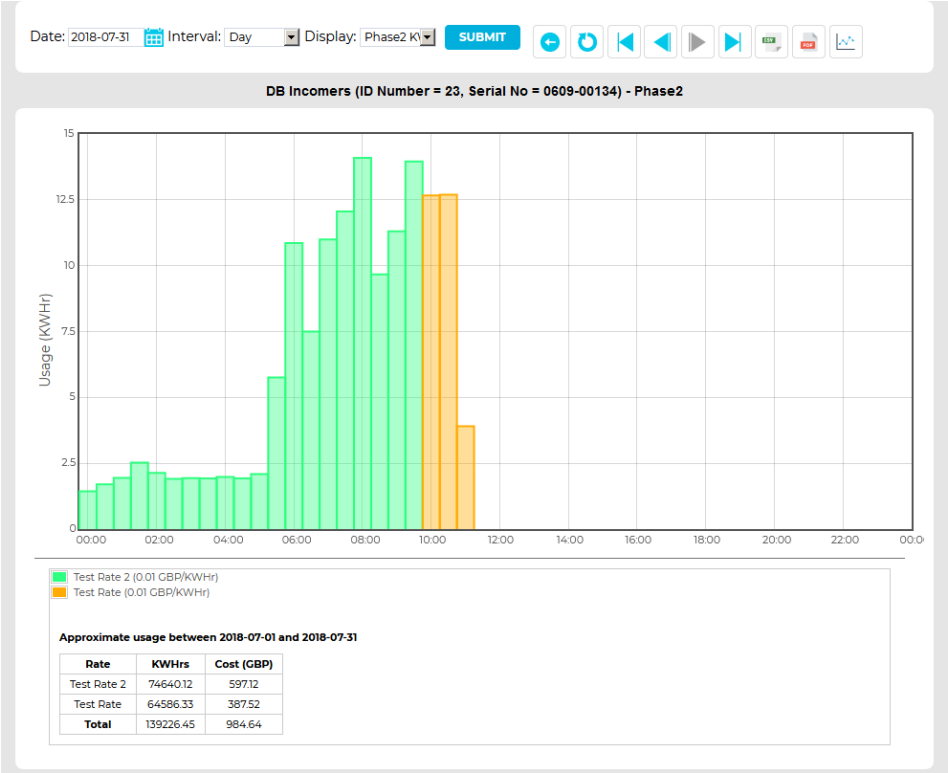


Figure 58

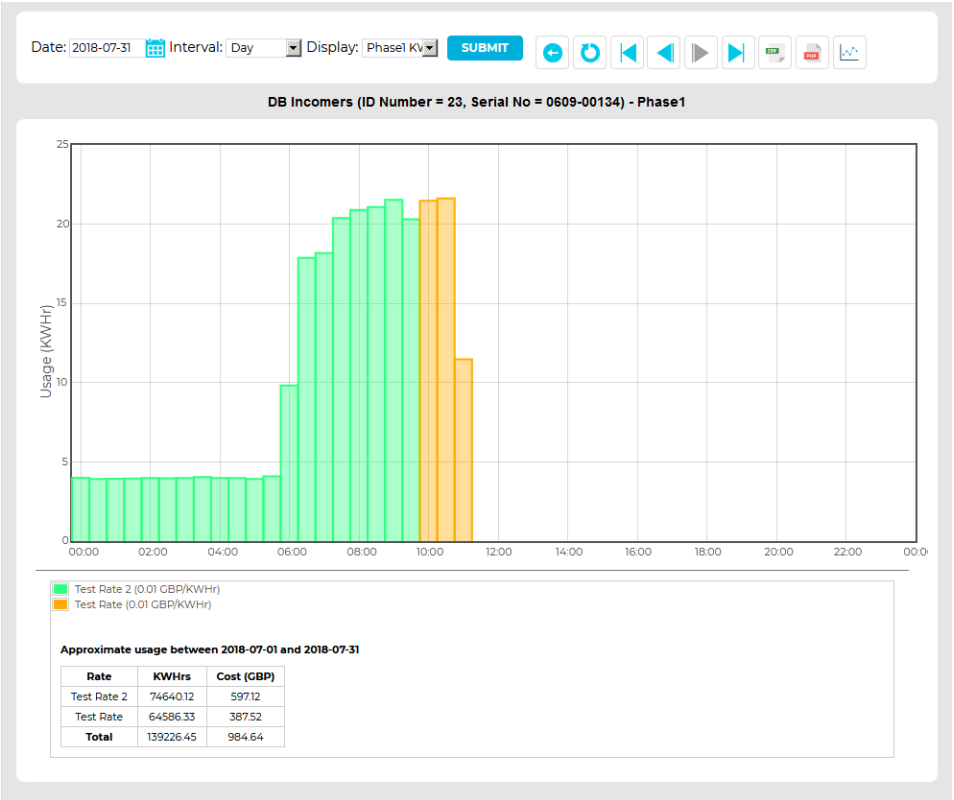


Figure 59

Appendix 1
Setting up a Current Clamp System with Synergy

A 1 .1 Adding the Current Clamp System to Synergy

Refer to the Synergy Online User Guide for details on how to add Sensor/Transmitter Units to Synergy, in particular the following Sections:

http://www.synergyhelp.co.uk/index.html?add-assign-sensors-to-a-zone.html

http://www.synergyhelp.co.uk/index.html?hardware-installation.html

A 1 .2 Configuring the Current Clamp System in EMS

To set up a Current Clamp system to work with Synergy, having added the RL4106 Transmitter Unit and associated Current Clamp sensors to Synergy as a 'Current Clamp Sensor', the following steps need to be completed:

- Enter the Current Clamp System's Calibration Settings into Synergy (See: **Section A 1.2.1 - Entering a Current Clamp System's Calibration Settings into Synergy**).
- Use the **Synergy Management Tools** to synchronise the Current Clamp system with Synergy to:
  - Download its **Physical Transmit ID** from Synergy.
  - Load the RL4601 Transmitter Unit and associated Current Clamp sensors' Calibration Settings into the RL4601 Transmitter Unit from Synergy.

  (See: **Section A 1.2.2 - Synchronising a Current Clamp System Using Synergy Management Tools**)

A 1.2.1 Entering a Current Clamp System's Calibration Settings into Synergy

In Synergy:

1. In the left-hand menu of the **Editing and Configuration** (**View Data** > **Edit Mode**) window, navigate to the icon representing the RL4601 Unit, as outlined in the **Accessing Sensor Properties** section of the **Synergy Online User Guide**:

   http://www.synergyhelp.co.uk/index.html?accessing-sensor-properties.html
2. Click on the + sign next to the RL4601's icon to access the **Properties** icon.
3. Click on the + sign next to the **Properties** icon in the left-hand menu to display the **Calibration** icon.
4. Click on the + sign next to the **Calibration** icon to expand the **Calibration Property** entries. See Figure 60 below.

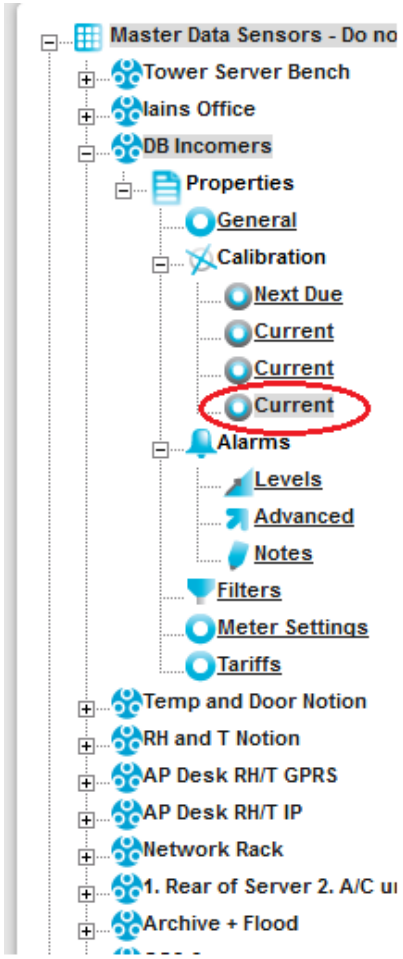


Figure 60

5. Click on the **Current** Clamp Sensor's icon (see Figure 60 above) to display the Configuration Window for the selected Current Clamp Sensor. See Figure 61 below:

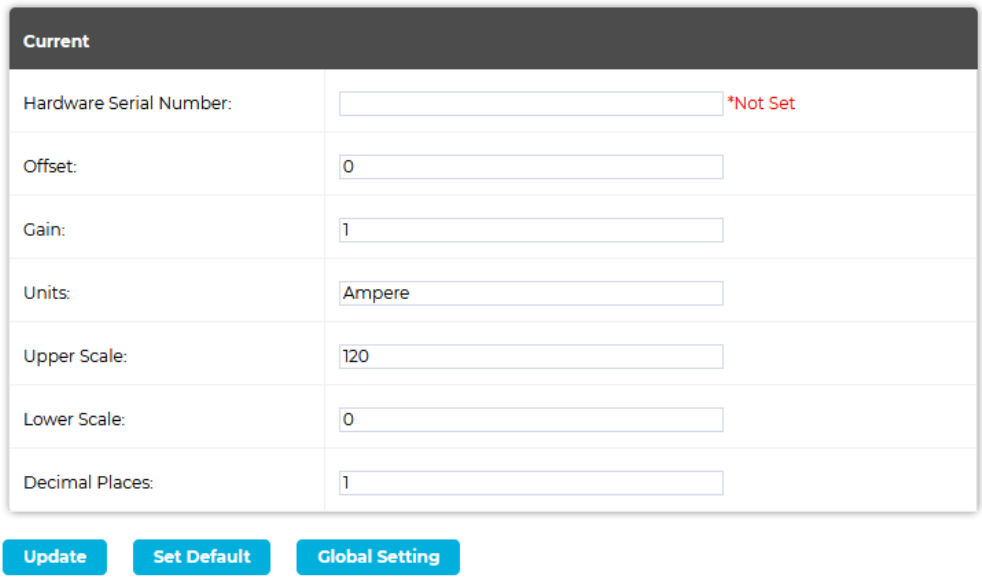


Figure 61

6. In the displayed Configuration Window, enter the **Calibration** values for the Temperature Sensor/Probe into their respective fields.

   ➢ These values are listed in the table at the top of the Box Insert.

   Note: Should you wish to carry out your own calibration of the sensor/probe, please refer to both the EMS Online User Guide:

   Error! Hyperlink reference not valid.

   and the following links:

   http://pd.hanwell.com/Cal-linear-sensor.xls
   http://pd.hanwell.com/Cal-linear-sensor.zip

7. Select **Update** to confirm the details and load the **Calibration** values into EMS.

   ➢ If the Update has been successful, the following message will be displayed. See Figure 62 below:

Figure 62

8. Repeat Steps 1 -7 above for all required RL4601 Units.

A 1.2.1.1 Setting Alarms

To set Alarm Parameters and Levels, refer to the following section in the Synergy Online User Guide: **Error! Hyperlink reference not valid.**

A 1.2.2 Synchronising a Current Clamp System Using Synergy Management Tools

The Synchronise process:

- Sets the **Physical Transmit ID** of the RL4601 Sensor Unit.

  And

- Takes the Sensor Calibration settings for the selected RL4601 Unit Sensor Unit and loads the **Calibration** and **Alarm** settings from the EMS Database into the Unit:

To Synchronise a Sensor:

1. Ensure that the RL4601 Unit to be synchronised is connected to the PC/Server running the EMS application, via the supplied **Y055** USB lead.
2. Open the **Synergy Management Tool** application.

   ➢ The **Synergy Management Tools** provide a physical link to the database and would be used when it is possible to connect the RL4601 Unit directly to the PC with EMS installed via the **Y055** USB lead.
   They also provide an HTTP link to data in the Synergy database, allowing you to

synchronise an RL4601 Unit when using Synergy installed on a Virtual Machine (VM).

Refer to the following sections in the Synergy Online User Guide:

http://www.synergyhelp.co.uk/index.html?synergy-remote-management-tool.html

Or:

The **Synergy Management Tool Manual** (Document Number: **IM5210**)

3. Select a Current Clamp sensor from the Synergy Management Tools' **SYNERGY Management** window. See Figure 63 below.

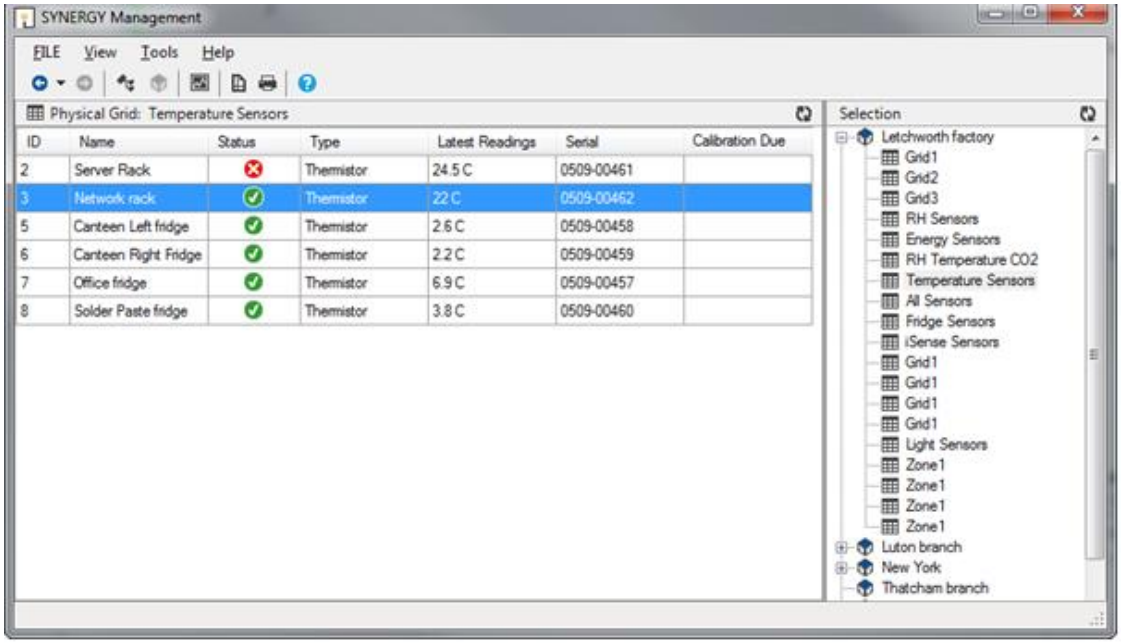


Figure 63

4. From the **SYNERGY Management Tools** window, select **Sync Selected Sensor** or **Current Clamp Configuration** from the **Tools** entry in the **Main Menu** bar. See Figure 64 below:

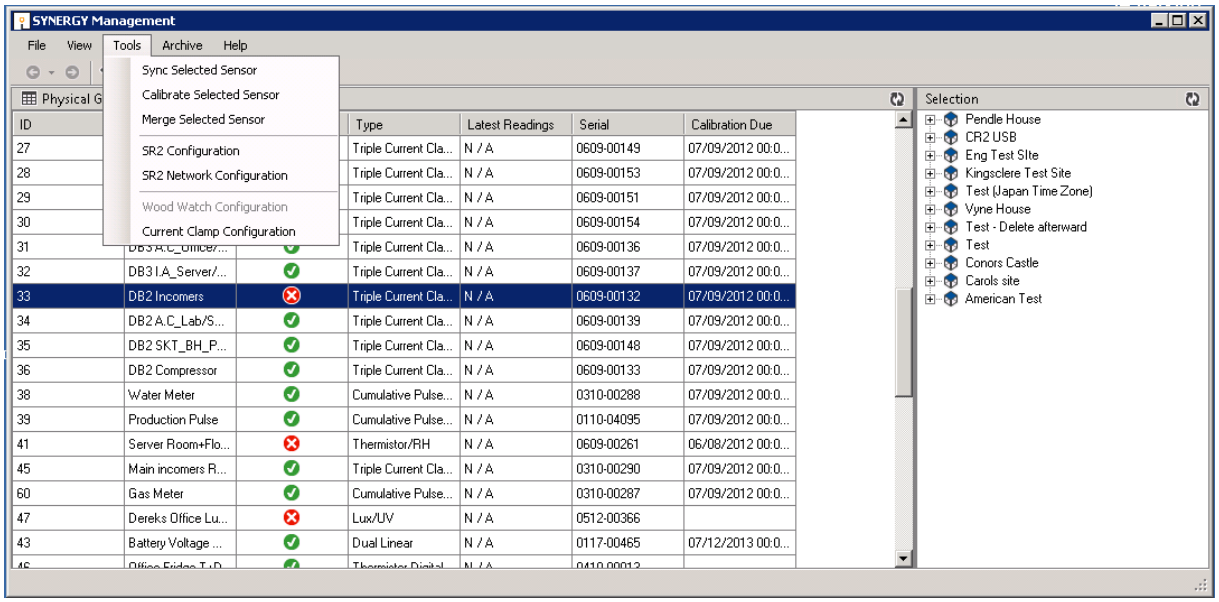


Figure 64

➢ The **Current Clamp Configuration V2.2** window, as shown below. See Figure 65 below:

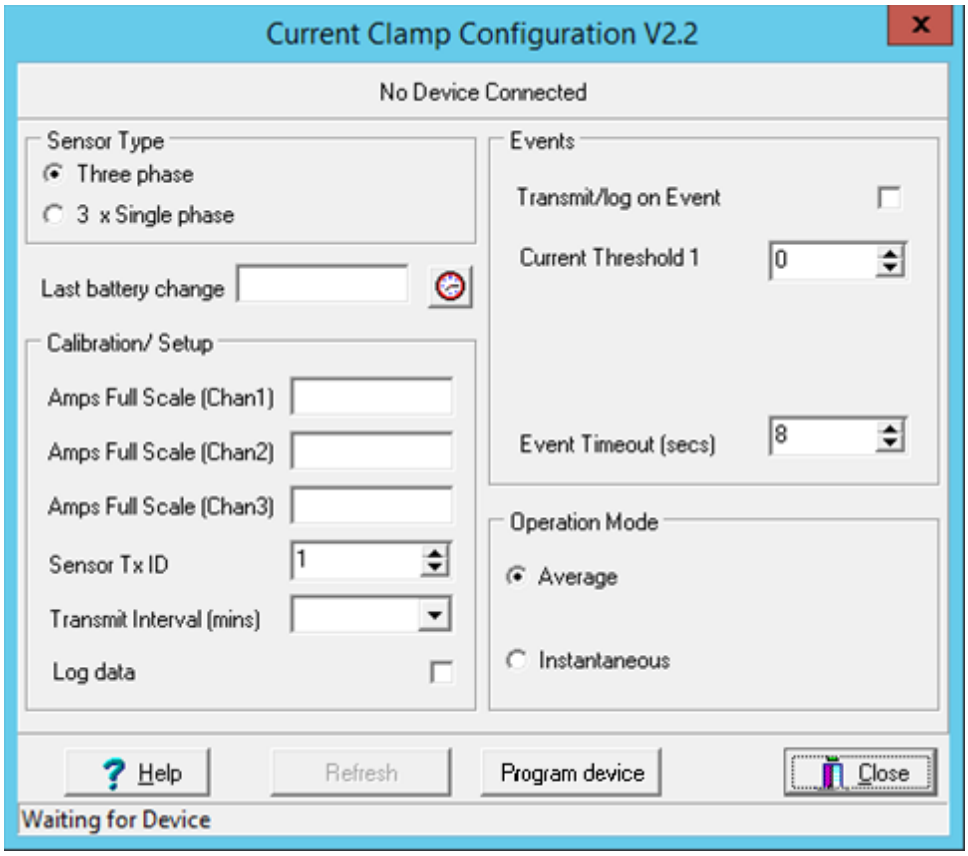


Figure 65

Note: The above window is from the Windows Server 2012 R2 operating system. The appearance of the window in Windows Server 2008 R2 or Windows 7 would be slightly different.

The Configuration Parameters available through this window are outlined below:

- **Log/Transmit Interval**
  - 10 seconds to 24hours (**HL4601**).
  - 1, 2, 3, 5, 15, 30 or 60 minutes (**RL4601/4602**).
- **Operation Mode**
  - **Average** or **Instantaneous**.

    Note: **Average** is recommended, particularly for the radio devices.
- **Full Scale on the Current Clamps**
  - Nominally 30.0, 60.00 or 120.0 Amps.
  - If a channel is unused, then set this to 0.
- **3 x Single Phase** or **Three Phase**

  The **ONLY** effect of this setting is related to the event logging.
  - If **Three Phase** is selected, one current threshold will be applied to all clamps. See Figure 66 below:

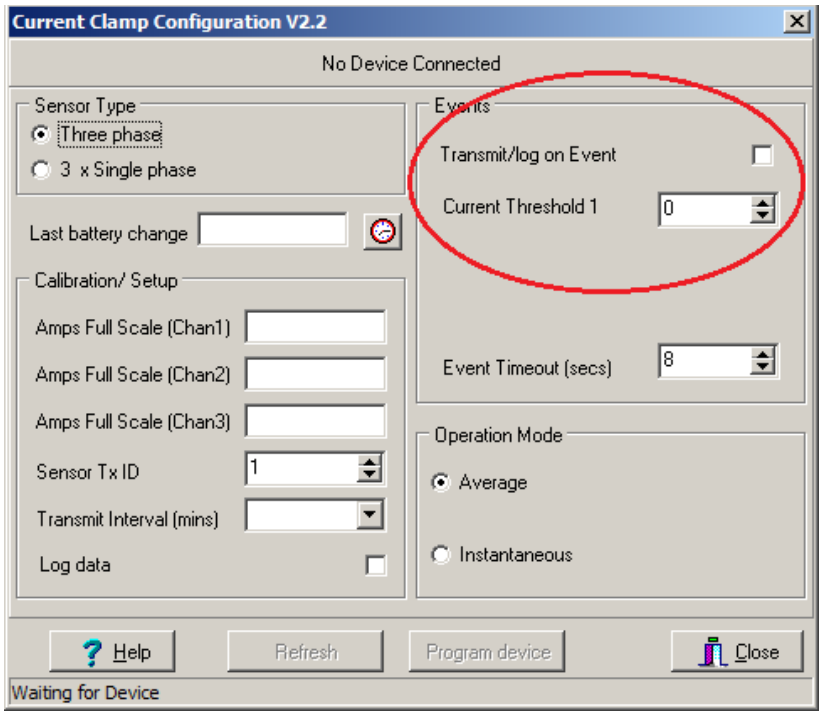


Figure 66

  - If **3 x Single Phase** is selected, then three individual thresholds can be entered. See Figure 67 below:

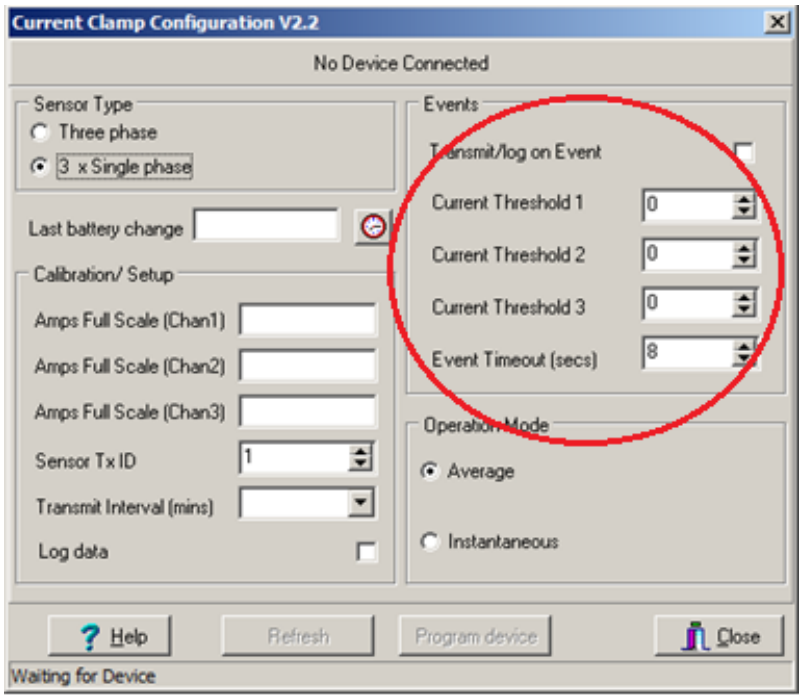


Figure 67

- **Transmit/Log on Event**

  React to high current levels

- **Event Timeout**

  Maximum time in seconds that event is considered live.

  Keep this value as small as reasonable to maximise battery life and minimize radio traffic (RL4106)

- **Current Thresholds**

  As required, set to 0 if not required on a particular channel.

- **Battery Change Date**

  A record is kept in the device

- **Identification**

  HL4601 only - A string reflecting the intended usage, e.g. 'Main Feed'

- **Transmitter ID**

  RL4601/4602 only - The ID used within Radiolog.

5. Enter or select the required values.
6. Click on **Program device** to synchronise the Sensor.

A 1 .3 Meter Tariffs

Use **Meter Tariffs** to define billing strategies.

- A Tariff consists of one or more bands (time periods within the day) together with an associated unit cost.

  For example, a Tariff might consist of a Peak Rate during the day with a lower cost off-peak charge in the early hours. All 24 hours must be covered.

- Each band has a **Rate** associated with it.

  Rates must be defined before creating **Meter Tariffs**.

A 1.3.1 Creating Meter Tariffs

A 1.3.1.1 Defining Rates

1. Select **Edit Mode** from the main **View Data** menu.
2. Select the required Current Clamp Sensor in the left-hand tree and expand its entry by clicking on the + icon. See Figure 68 below:

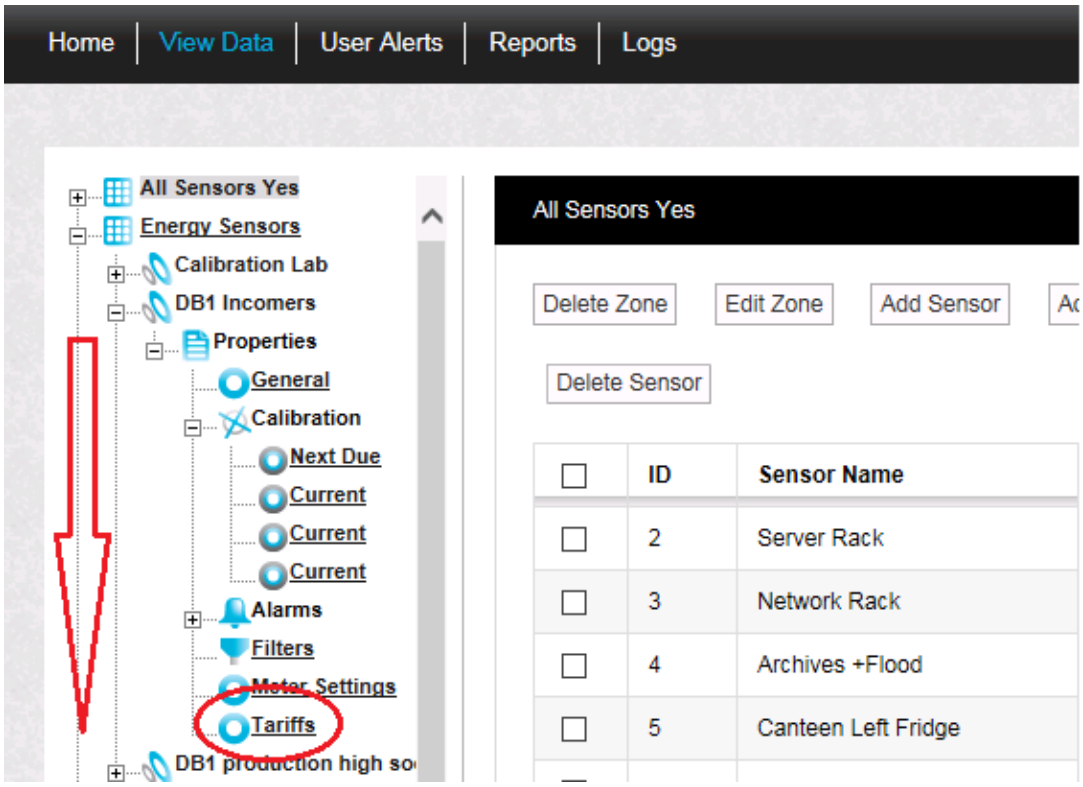


Figure 68

➢ For details on accessing **Edit Mode** and Sensor details, refer to the EMS Online Manual:
http://www.synergyhelp.co.uk/index.html?system-configuration-sensors.html
http://www.synergyhelp.co.uk/index.html?accessing-sensor-properties.html

3. Click on the **Tariffs** entry. See Figure 68 above.

➢ The **Meter Tariffs** window is displayed. See Figure 69 below:

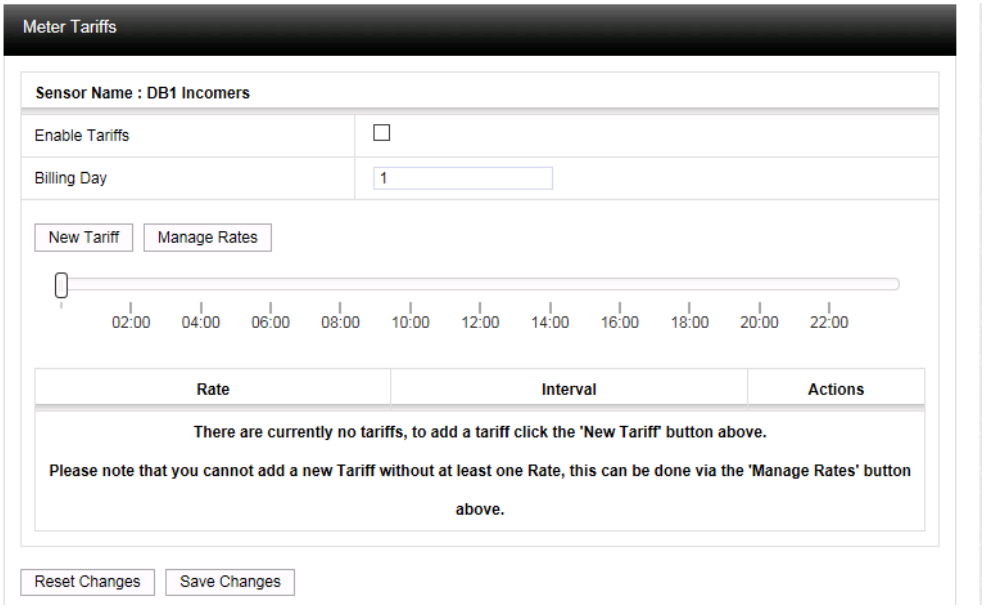


Figure 69

4. In the **Meter Tariffs** window, click on the **Manage Rates** button.

➢ The **Rates** window is displayed. See Figure 70 below:

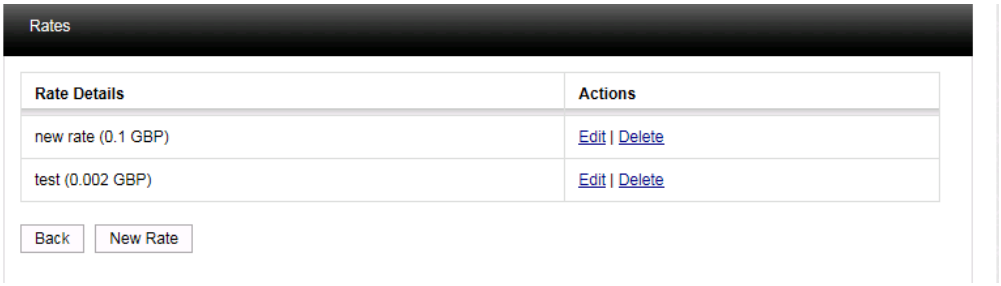


Figure 70

5. **Either:**

Click on **[Edit]** to adjust an existing Rate.

➢ The **Edit Tariff Rate** window is displayed. See Figure 71 below:

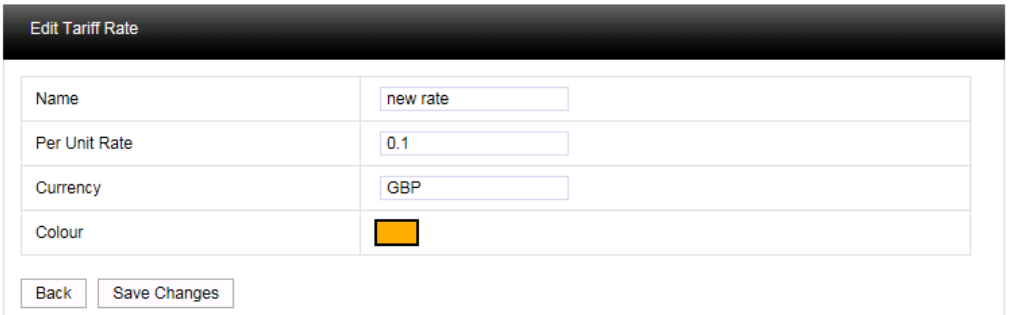


Figure 71

Or:

Click on **New Rate** to define a new Rate.

➢ The **New Tarfiff Rate** window is displayed. See Figure 72 below:

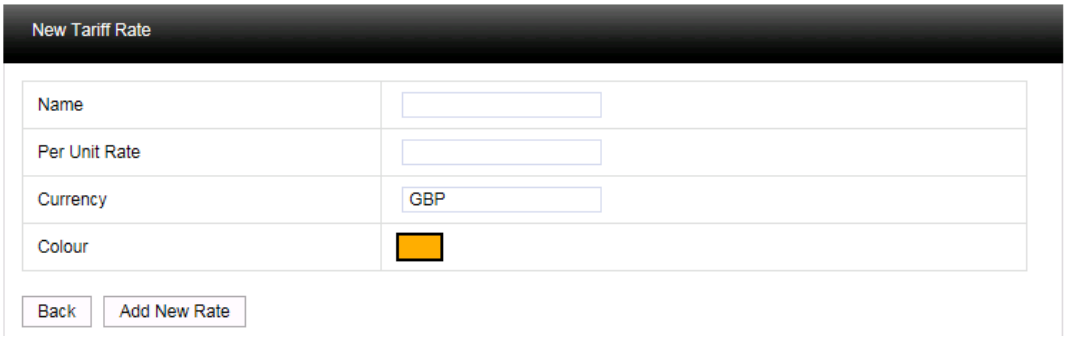


Figure 72

6. In the displayed window (**New Tariff Rate** or **Edit Tariff Rate**), enter or edit the following details:

➢ An identifying **Name** for the Rate.
➢ The **Tariff's Per Unit** Rate.
➢ The **Currency** the Rate is to be charged in.
➢ A **Colour** from the palette to identify/highlight the Rate. See Figure 73 below:

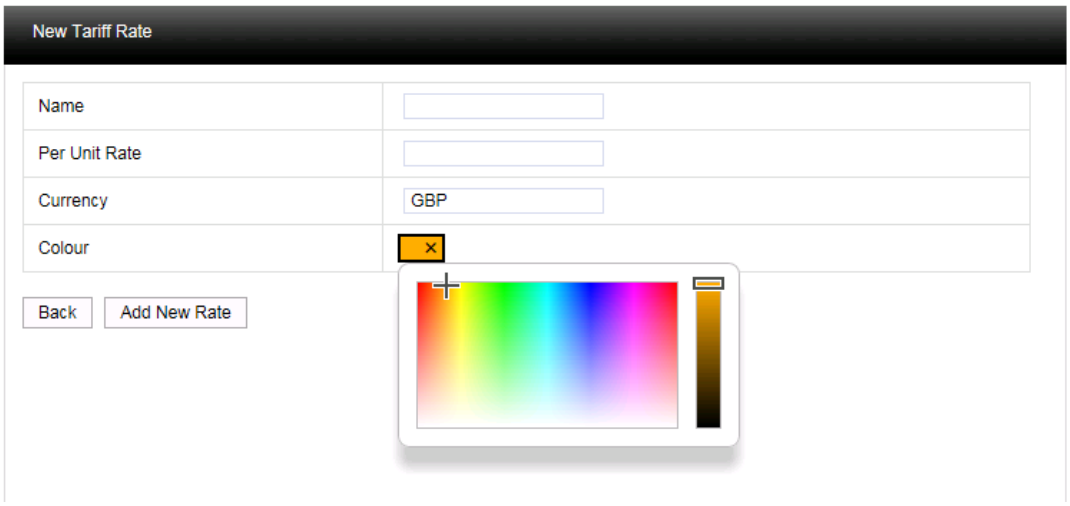


Figure 73

* Click on the colour block to display the Palette.

7. When complete, click on **Save Changes** (**Edit Tariff Rate** window**)** or **Add New Rate** (**New Tariff Rate** window).

➢ The **Rates** window is displayed with a confirmation message. See Figure 74 below:

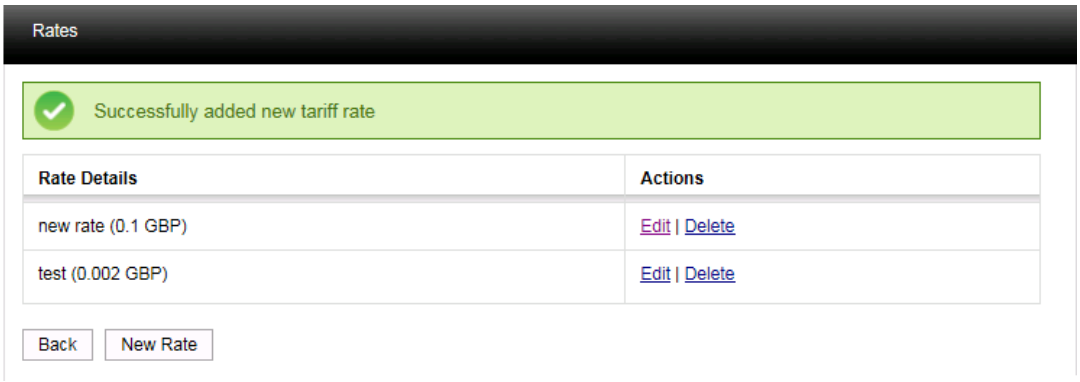


Figure 74

8. **Either:**

   Click on **Back** to return to the **Meter Tariffs** window. See Figure 69 above.

   Or:

   Click on **New Rate** to display the **New Tariff Rate** window, see Figure 73 above, from where you can define a new, additional, Rate.

A 1.3.1.2 Creating Meter Tariffs

To Define a Meter Tariff:

1. Check the **Enable Tariffs** box in the **Meter Tariffs** window. See Figure 75 below:

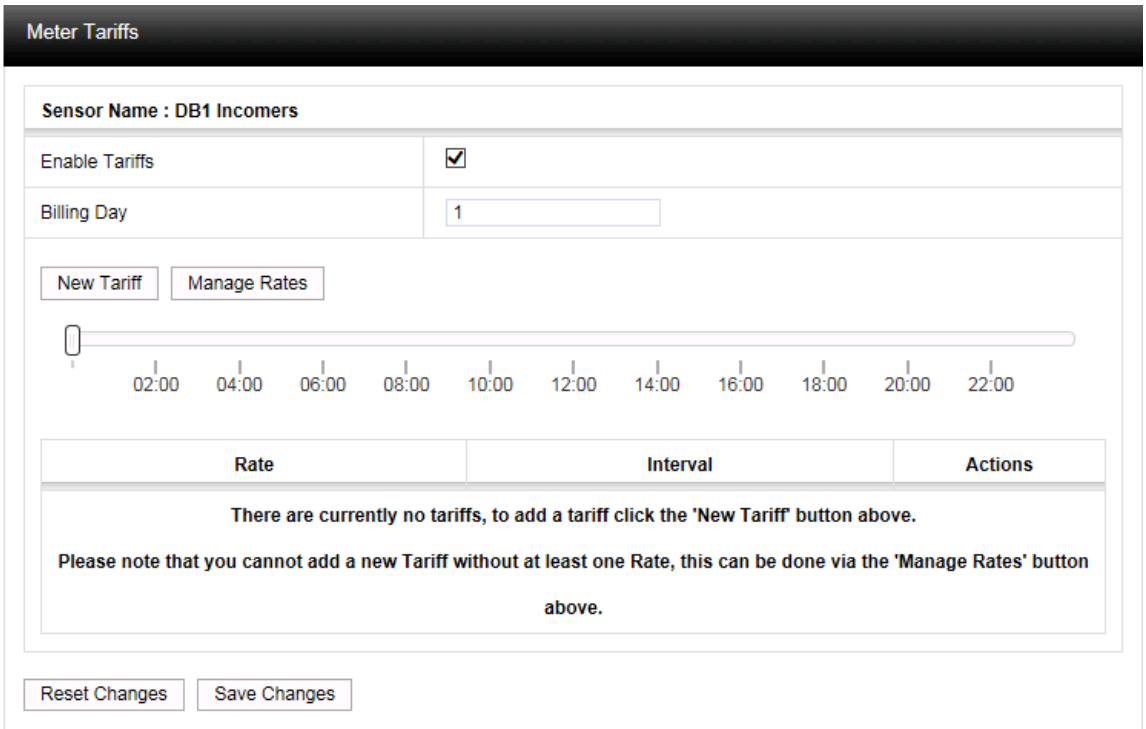


Figure 75

2. Click on **New Tariff** in the **Meter Tariffs** window.

   ➢ The **Meter Tariffs** window displays a **Test Rate** for the Tariff, highlighting the

Slider bar with the Rate's defined colour (see Figure 73Figure 75 above) as shown in Figure 76 below:

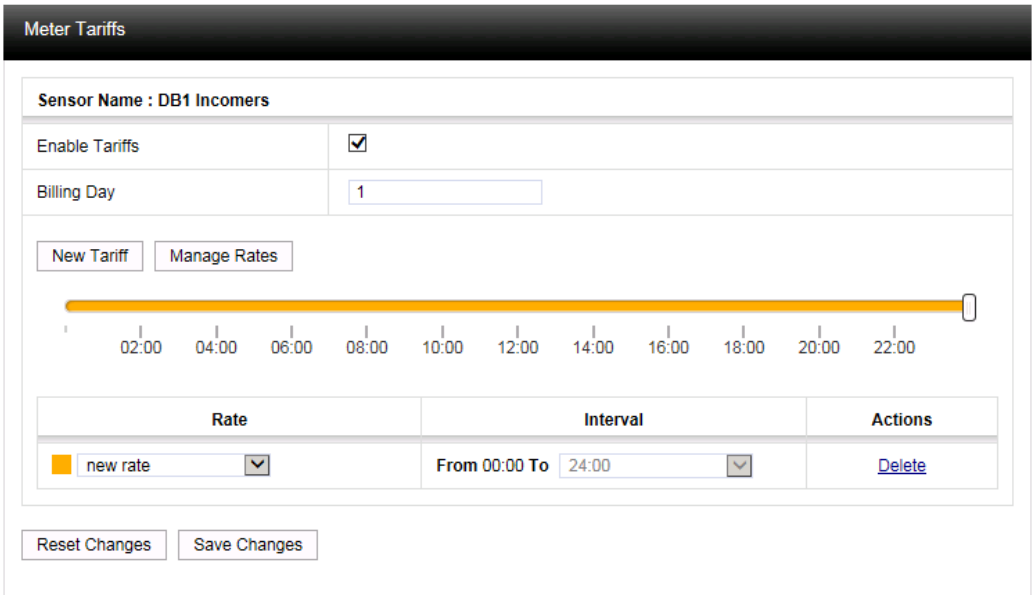


Figure 76

- By default, the first Rate defined in the **Rates** window (see Figure 74 above) is displayed.

  Note: Initially, as only one Rate is associated with the Tariff, the Interval entry for the Rate will be inactive as the Rate will apply for the full 24 hour period.

- To allocate another Rate to the Tariff, click on the **Rate** drop down menu and select one of the displayed Rates. See Figure 77 below:

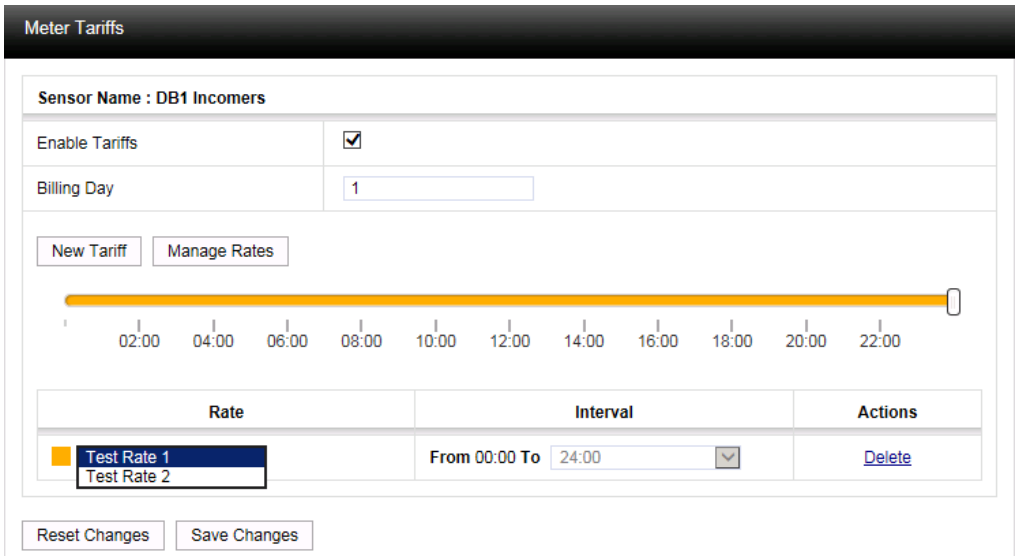


Figure 77

To Define Further Meter Tariffs:

1. Click on the **New Tariff** in the **Meter Tariffs** window.

   ➢ The new Tariff is displayed in the **Meter Tariffs** window. See Figure 78 below:

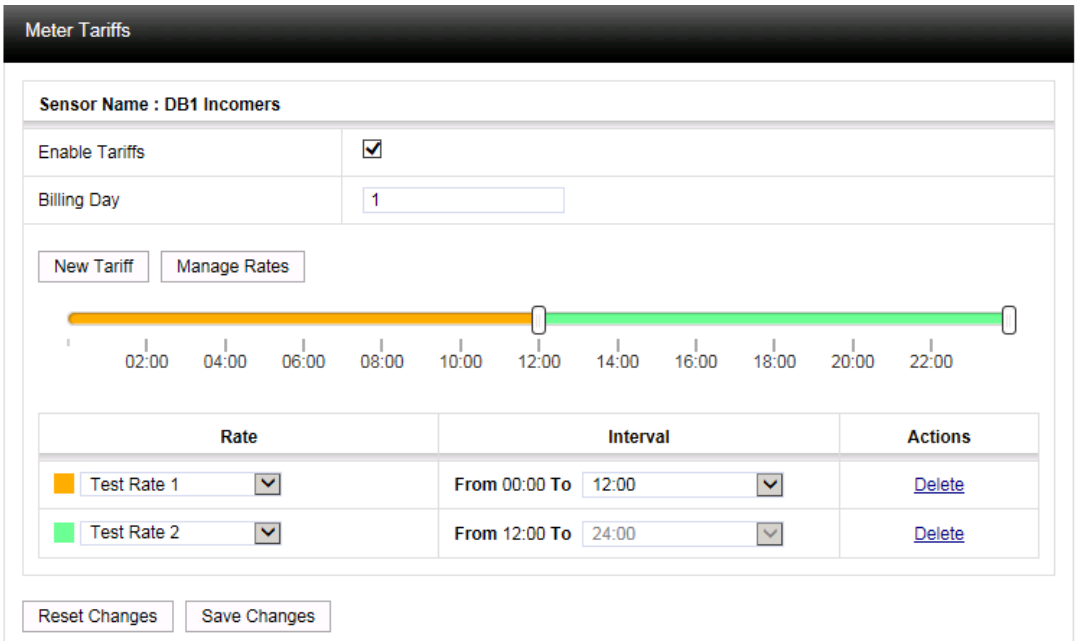


Figure 78

   ➢ The Slider bar shows the defined colours for each of the Rates allocated to the displayed Tariffs.

   ➢ By default each Tariff is allocated a 12 hour period of activity. These periods can be varied by:

   Either

   Moving the Slider left or right to adjust the time each Tariff is active for.

   Or

   Selecting a time from the **Interval** drop down list.

   See Figure 100 above.

   Note: The Interval drop down list will be inactive for the second Tariff added the time it is active in any 24 hour period is determined by the time period set for the first Tariff.

2. As with the first Tariff, select a Rate for it from its **Rate** drop down list. See Figure 78 above.

   ➢ Further Tariffs are added and their Rates selected in the same way. See Figure 79 below:

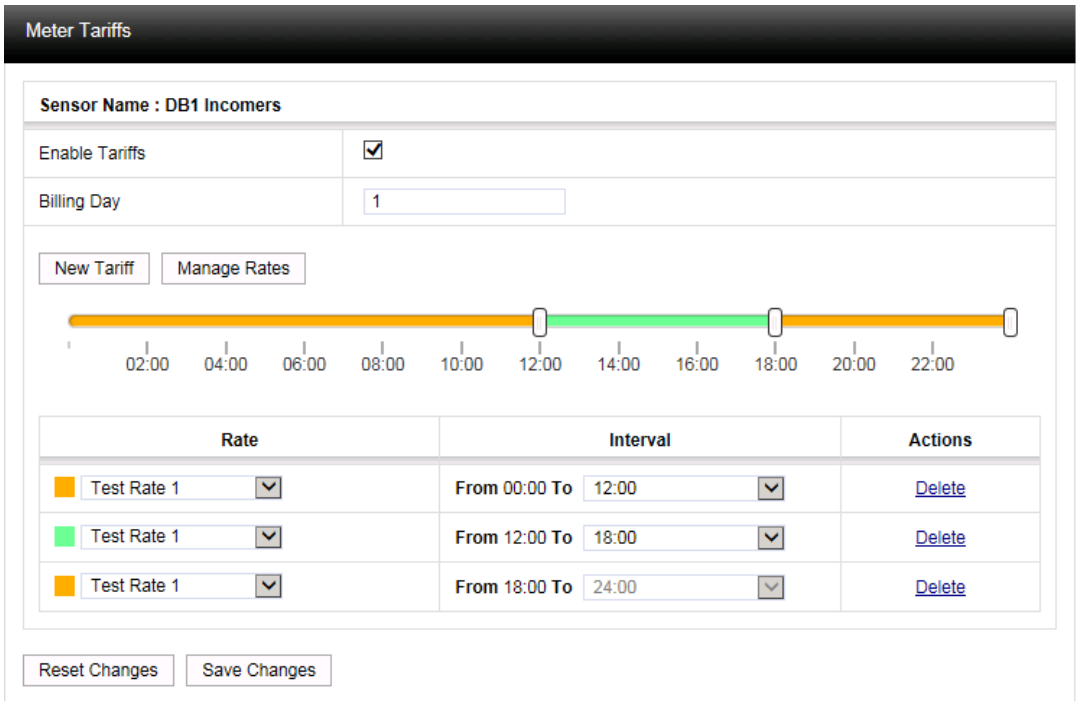


Figure 79

Note: The **Interval** drop down list will be inactive for the final Tariff added as the time it is active in any 24 hour period is determined by the time periods set for the first and second Tariffs.

3. When all Tariffs and associated Rates have been defined, click on **Save Changes**.

➢ The **Tariffs updated successfully** message is displayed. See Figure 80 below:

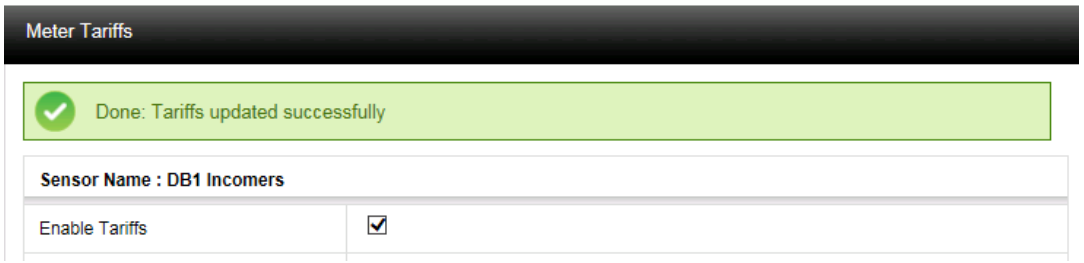


Figure 80

A 1 .4 Viewing Current Clamp Sensor Data

Viewing Sensor Data in Synergy is covered by the following Section of the EMS Online User Guide:

http://www.synergyhelp.co.uk/index.html?viewing-data2.html

A 1.4.1 Graphical Display of Current Clamp Sensor Data

To Display a Current Clamp Sensor's Data as a Graph:

1. From the Dashboard, click on **View Data**.

   ➢ From either the **Site's Dashboard icon**:

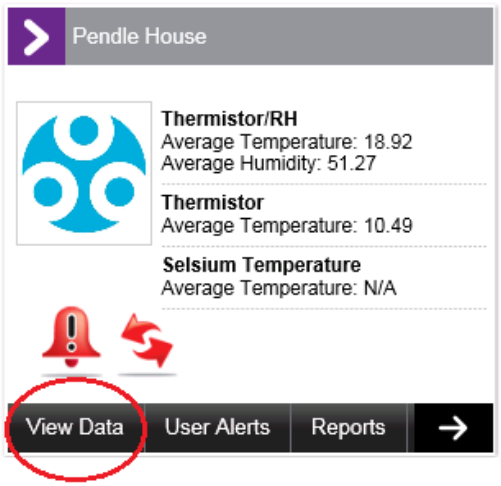


Figure 81

   ➢ Or the **Text View**:

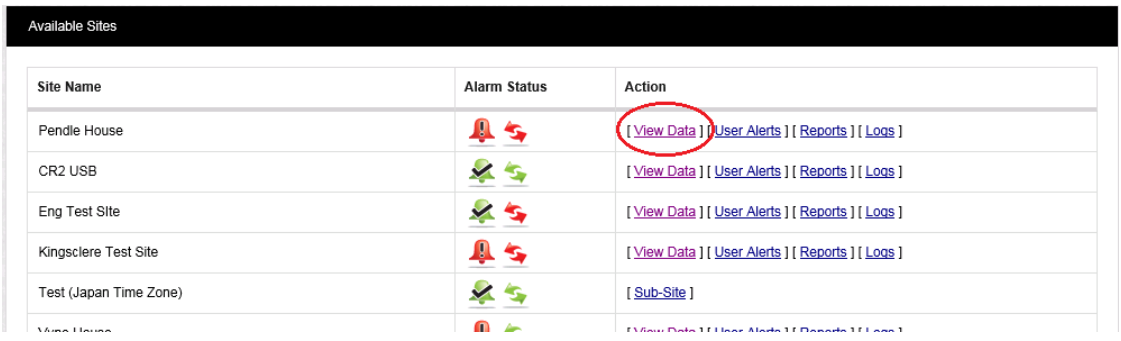


Figure 82

2. Select **View Data** on the left-hand side of the top menu bar. See Figure 83 below:

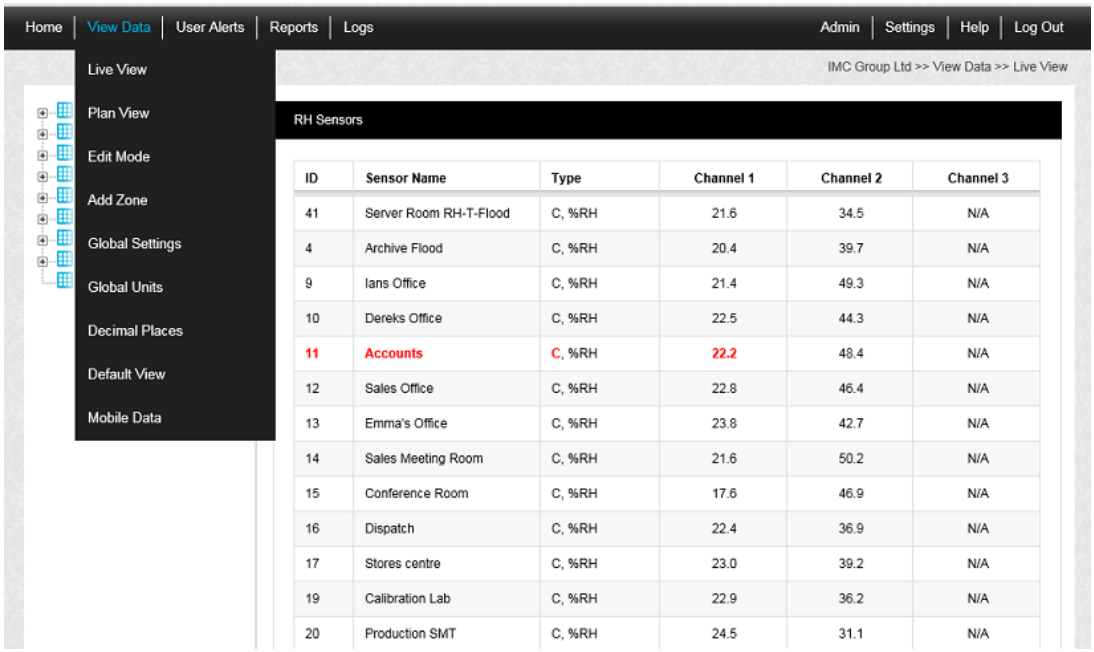


Figure 83

3. Click on **Live View** from the drop-down menu to access the **Live View Table** showing the **Sensors** associated with the selected **Zone**. See Figure 84 below:

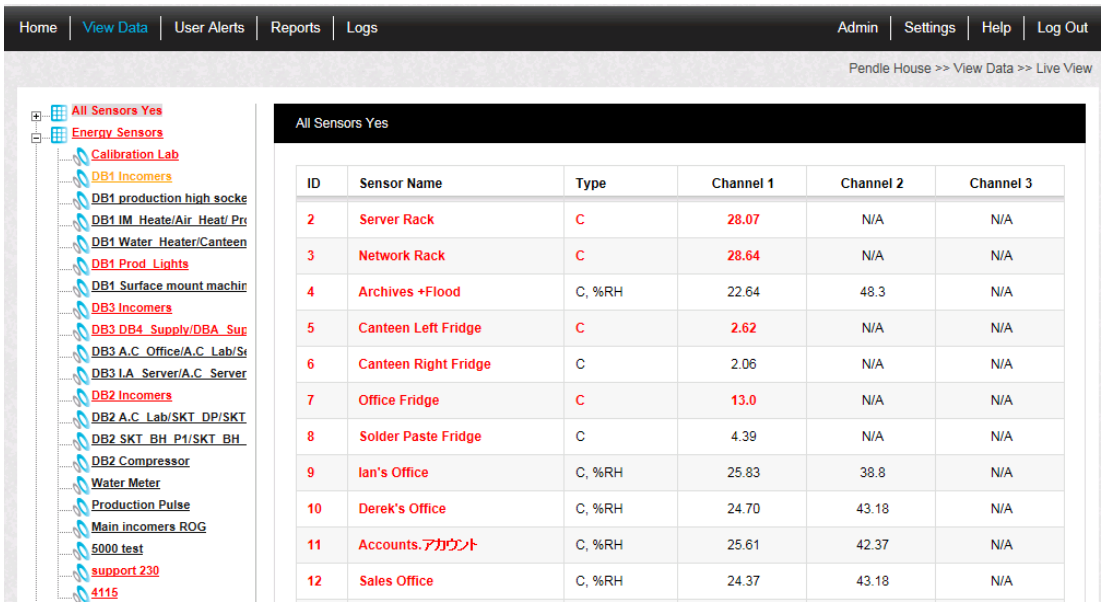


Figure 84

4. **Either:**

   Click once on the required **Sensor/Transmitter** name in the left-hand list (underlined entries).

   Or:

   Double-click on the Sensor name in the **Live View** list (right-hand list).

   ➢ The Current Clamp Sensor's data is displayed as a **Utilities Bar Chart** in the **Bar**

Chart [Sensor name] window, as shown in Figure 85 below:

Figure 85

Note the different colour used to highlight the different Rates. See **Section A 1 .3 Meter Tariffs**.

A 1.4.2 Viewing Current Phase Data

It is possible to display separate bar charts for each phase of a 3-phase power system as follows:

1. From the **Display:** drop-down list, select the required Phase to display and the Units to use (KW/hr or GBP). See Figure 86 below:

   ➢ A graph of all three phases can also be displayed.

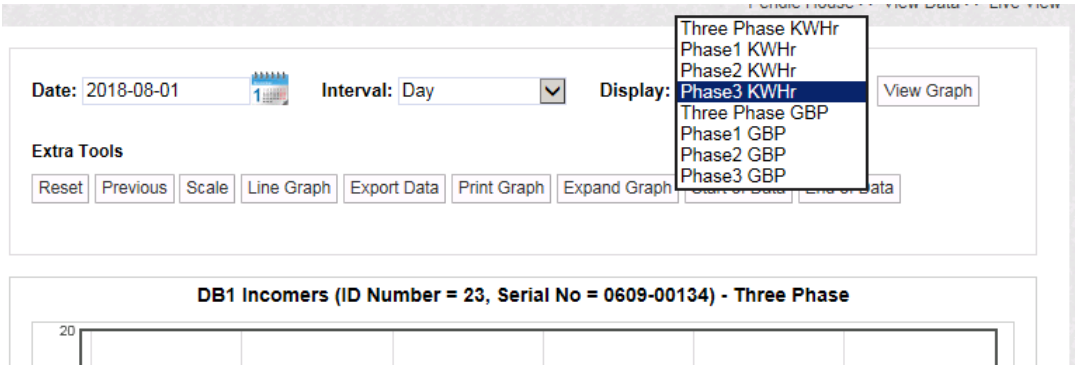
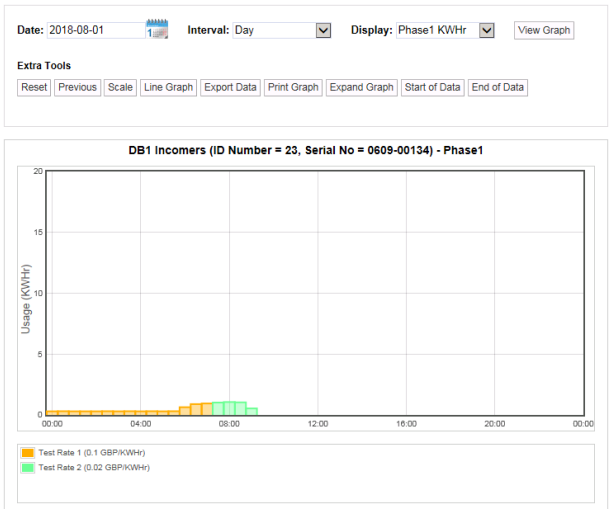


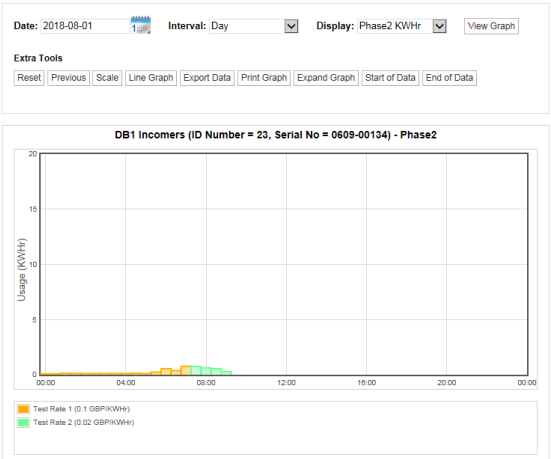
Figure 86

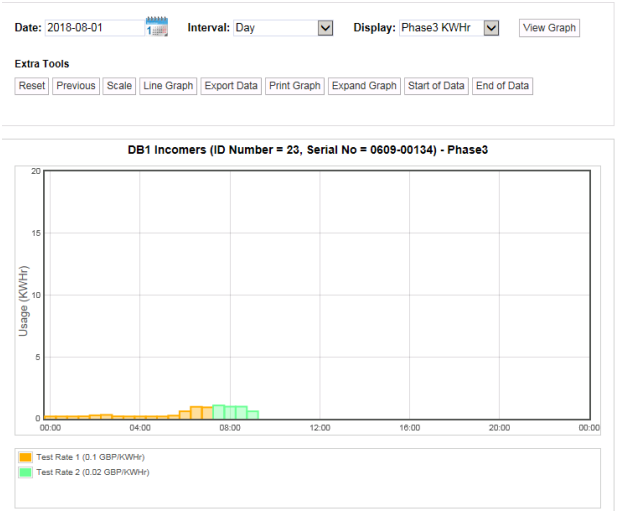
2. Click on **View Graph**

   ➢ The Bar Chart for the selected Phase is shown.

The bar charts below show examples of the separate displays for each phase of a of a 3-Phase supply.







Appendix 2
Setting up a Current Clamp System in Versions of EMS prior to Version 1.0.9/2.0.3 (Compliant)

A 2 .1 Adding the Current Clamp System to EMS

Refer to the EMS Online User Guide for general details of how to add Sensor/Transmitter Units to EMS, in particular the following Sections:

http://www.help.emsprocloud.com/index.html?add-assign-sensors-to-a-zone.html

http://www.help.emsprocloud.com/index.html?hardware-installation.html

A 2 .2 Configuring the Current Clamp System in EMS

To set up a Current Clamp system to work with EMS, having added the RL4106 Transmitter Unit and associated Current Clamp sensors to EMS as a 'Current Clamp Sensor', the following steps need to be completed:

- Enter the Current Clamp System's Calibration Settings into EMS (See: **Section A 2.2.1 - Entering a Current Clamp System's Calibration Settings into EMS**).
- Use the **EMS Remote Management Tools** to configure the Current Clamp system i.e.:
  - Load the RL4601 Transmitter Unit and associated Current Clamp sensors Calibration Settings into the RL4601 Transmitter Unit from EMS.
  - Synchronise the RL4601 Unit with EMS to download its **Physical Transmit ID** from EMS.

  (See **Section A 1.2.2 Synchronising a Current Clamp System Using Synergy Management Tools**)

A 2.2.1 Entering a Current Clamp System's Calibration Settings into EMS

In EMS:

1. In the left-hand menu of the **Editing and Configuration** (**View Data** > **Edit Mode**) window, navigate to the icon representing the RL4601 Unit, as outlined in the **Accessing Sensor Properties** section of the EMS Online User Guide: http://www.help.emsprocloud.com/index.html?accessing-sensor-properties.html.
2. Click on the + sign next to the RL4601 icon to access the **Properties** icon.
3. Click on the + sign next to the **Properties** icon in the left-hand menu to display the **Calibration** icon.
4. Click on the + sign next to the **Calibration** icon to expand the **Calibration Property** entries. See Figure 87 below:

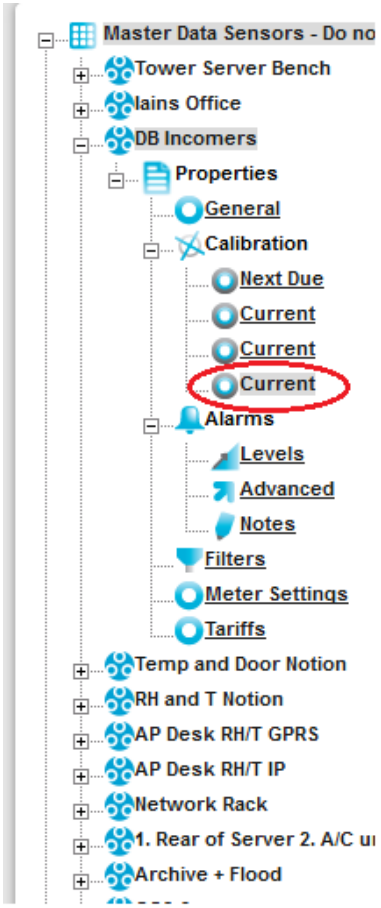


Figure 87

5. Click on the **Current** Clamp Sensor's icon (see Figure 87 above) to display the Configuration Window for the selected Current Clamp Sensor. See Figure 88 below:

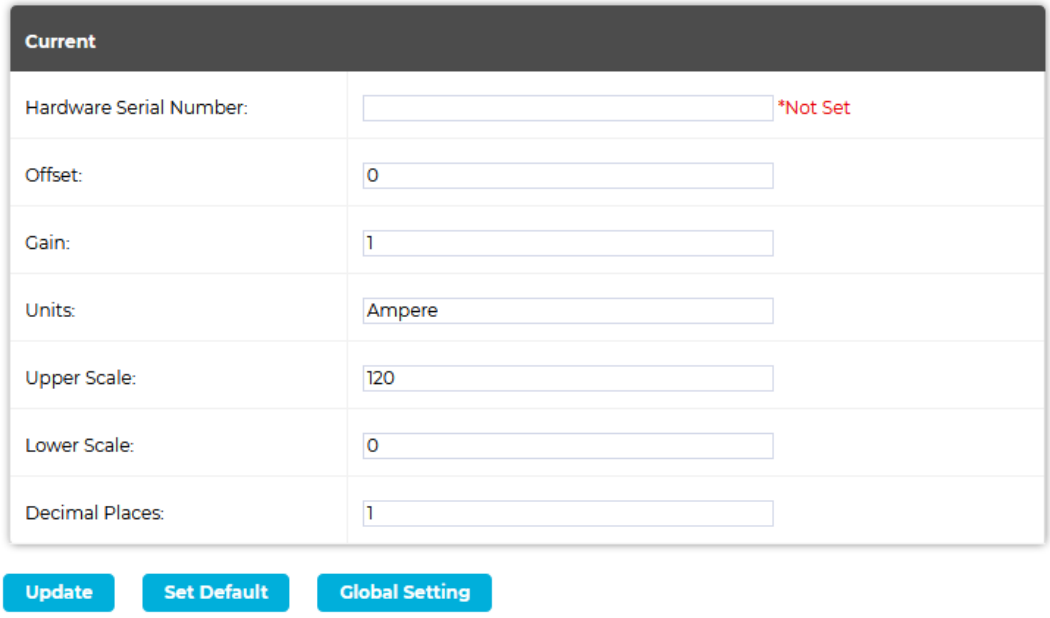


Figure 88

6. In the displayed Configuration Window, enter the **Calibration** values into their respective fields.

   ➢ These values are listed in the table at the top of the Box Insert.

   Note: Should you wish to carry out your own calibration of the sensor/probe, please refer to both the EMS Online User Guide:
   http://www.help.emsprocloud.com/index.html?calibration-management-tools.html

   and the following links:

   http://pd.hanwell.com/Cal-linear-sensor.xls
   http://pd.hanwell.com/Cal-linear-sensor.zip

7. Select **Update** to confirm the details and load the **Calibration** values into EMS.

   ➢ If the Update has been successful, the following message will be displayed. See Figure 89 below:

Figure 89

8. Repeat Steps 1 - 7 for all required Current Clamp Sensors.

A 2.2.1.1 Setting Alarms

To set Alarm Parameters and Levels, refer to the following section in the EMS Online User Guide:

http://www.help.emsprocloud.com/index.html?levels.html

9. After entering the Current Clamp Sensor(s) Calibration settings into EMS, you should then Synchronise them, following the procedure outlined in **Section A 1.2.2 Synchronising a Current Clamp System Using Synergy Management Tools**.

A 2 .3 Creating Meter Tariffs in a Version of EMS prior to Version 1.0.9 / 2.0.3 (Compliant)

A 2.3.1 Creating Meter Tariff Rates

1. From **Edit Mode** in the EMS interface, select the required Current Clamp Sensor in the left-hand tree and expand its entry by clicking on the + icon. See Figure 90 below:

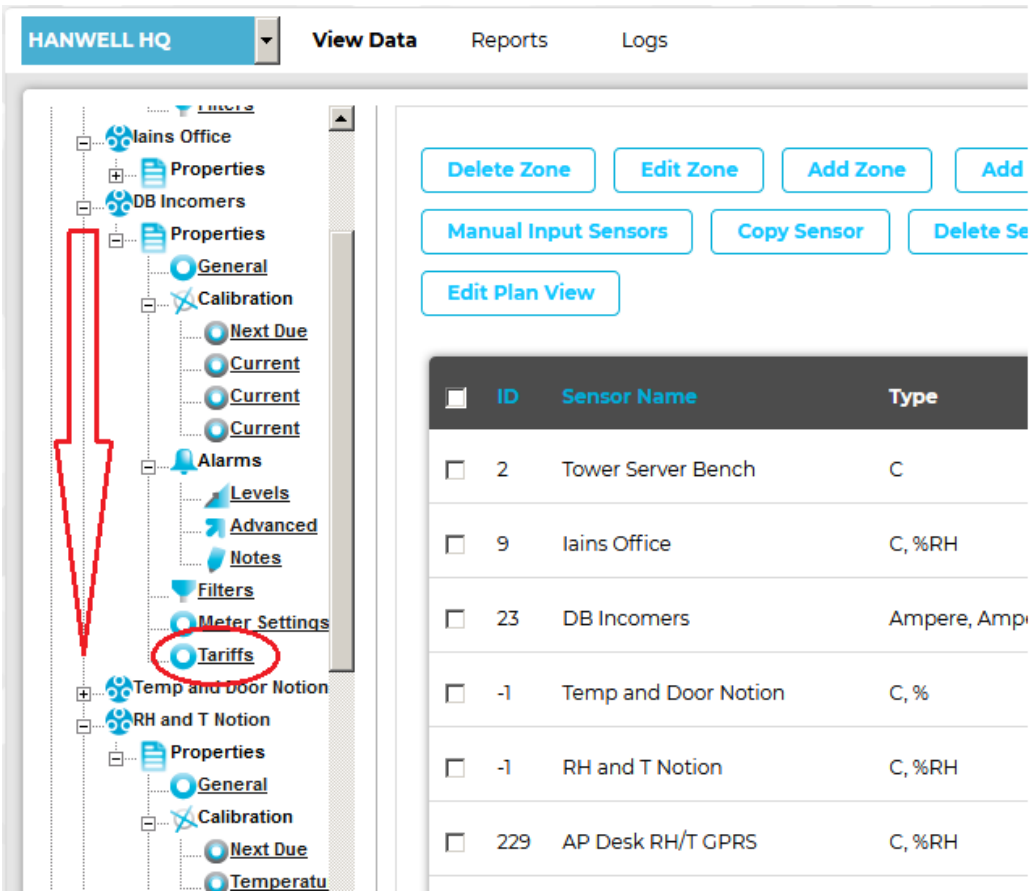


Figure 90

➢ For details on accessing **Edit Mode** and Sensor details, refer to the EMS Online Manual:

http://www.help.emsprocloud.com/index.html?edit-sensors.html

http://www.help.emsprocloud.com/index.html?system-configuration-sensors.html

http://www.help.emsprocloud.com/index.html?accessing-sensor-properties.html

2. Click on the **Tariffs** entry. See Figure 90 above.

➢ The **Meter Tariffs** window is displayed. See Figure 91 below:

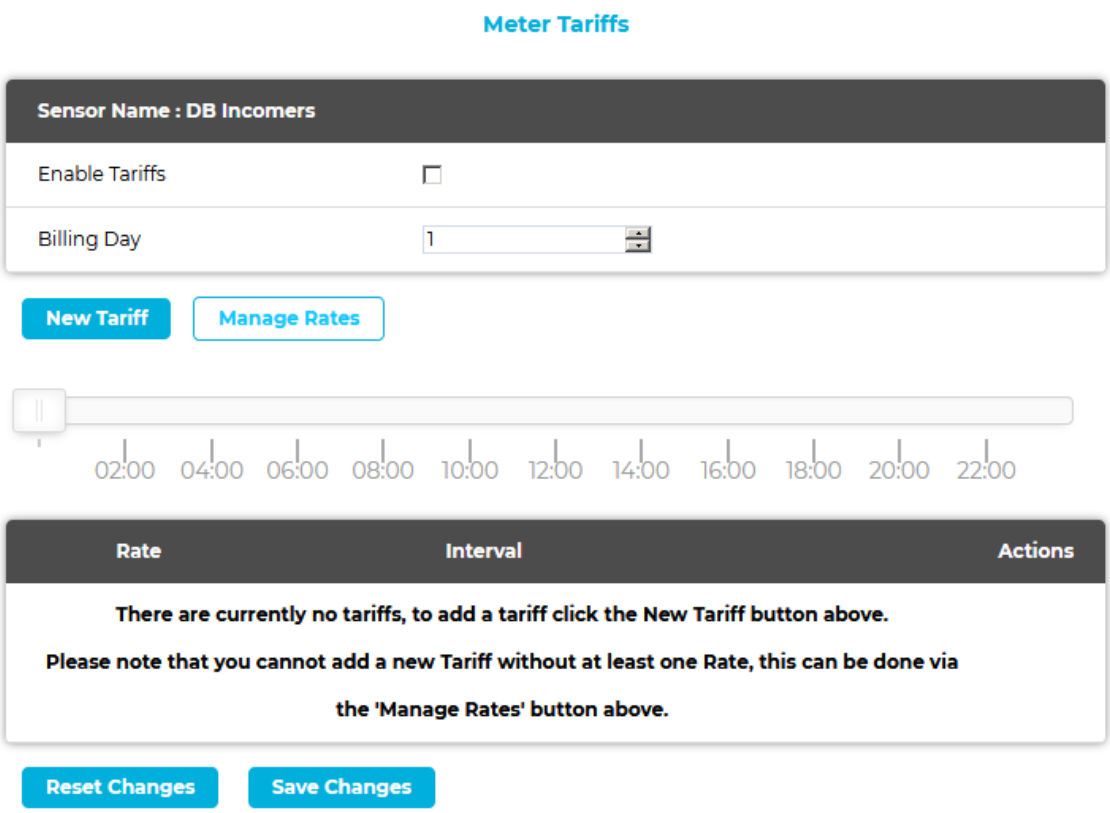


Figure 91

3. In the **Meter Tariffs** window, click on the **Manage Rates** button.

   ➢ The **Rates** window is displayed. See Figure 92 below:

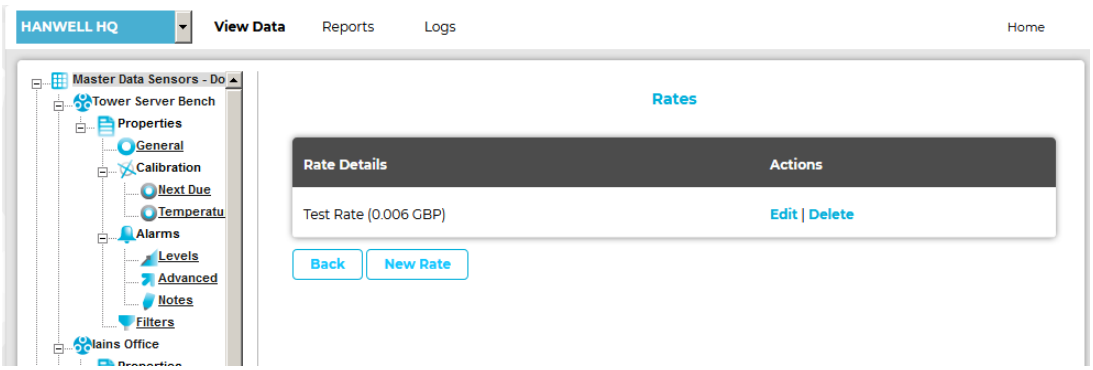


Figure 92

4. **Either:**

   Click on **[Edit]** to adjust an existing Rate.

   Or:

   Click on **New Rate** to define a new Rate.

   ➢ The **Edit Tarfiff Rate** window is displayed. See Figure 93 below:

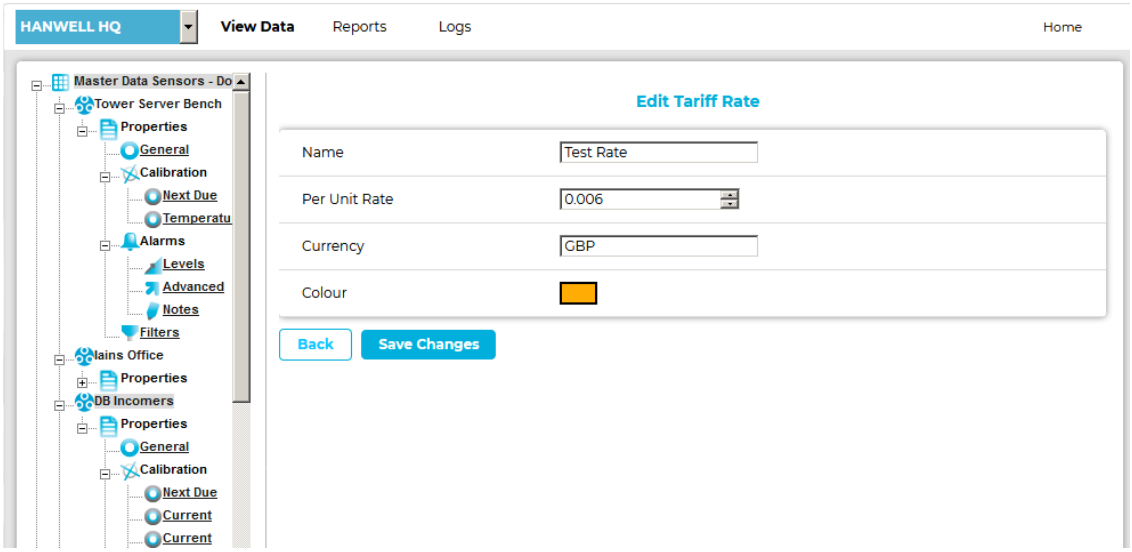


Figure 93

5. Enter (or edit) the following details:

   - An identifying **Name** for the Rate.
   - The **Tariff's Per Unit** Rate.
   - The **Currency** the Rate is to be charged in.
   - A **Colour** from the palette to identify/highlight the Rate. See Figure 94 below:

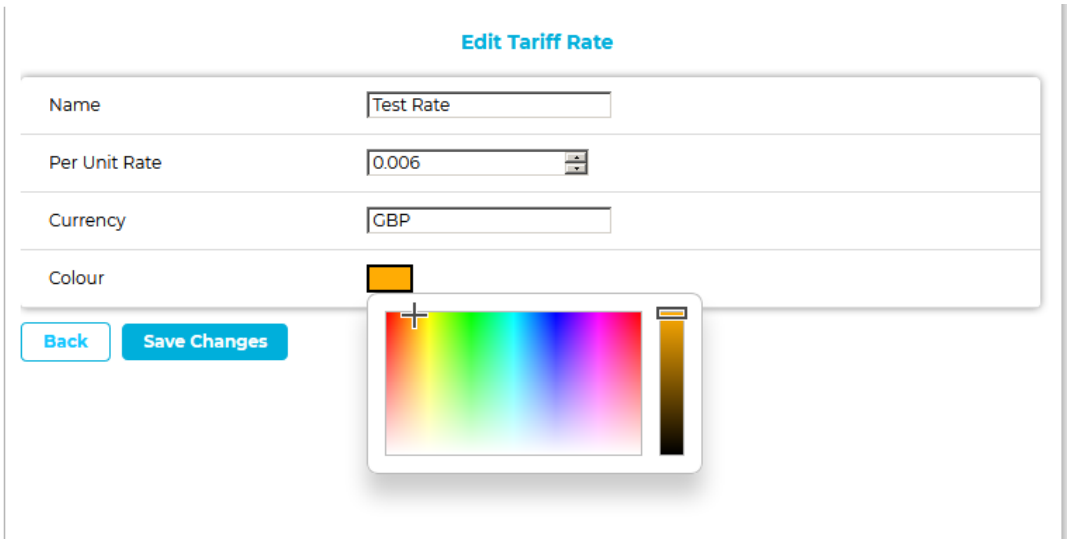


Figure 94

   * Click on the colour block to display the Palette.

6. When complete, click on **Save Changes**.

   - The **Rates** window is displayed. See Figure 95 below:

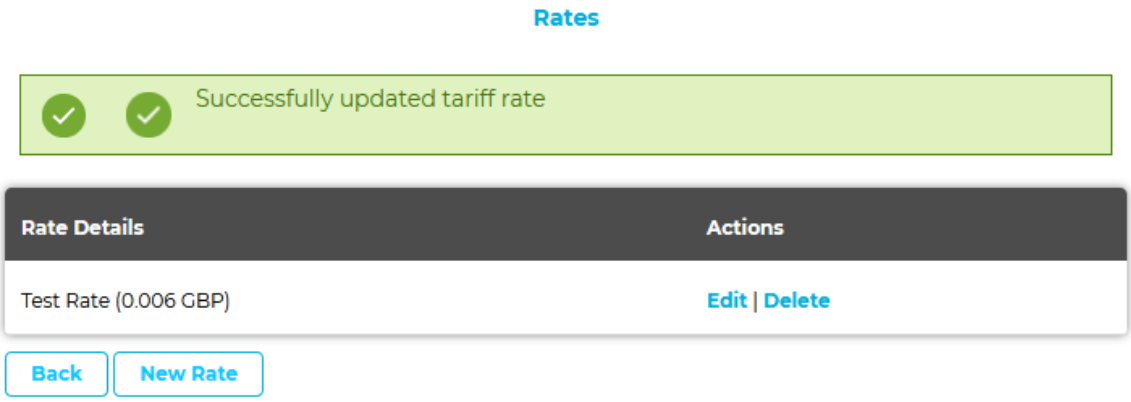


Figure 95

7. **Either:**

   Click on **Back** to return to the **Meter Tariffs** window. See Figure 92 above.

   Or:

   Click on **New Rate** (see Figure 92 above) to display the **New Tariff Rate** window, from where you can define a new, additional, Rate. See Figure 96 below:

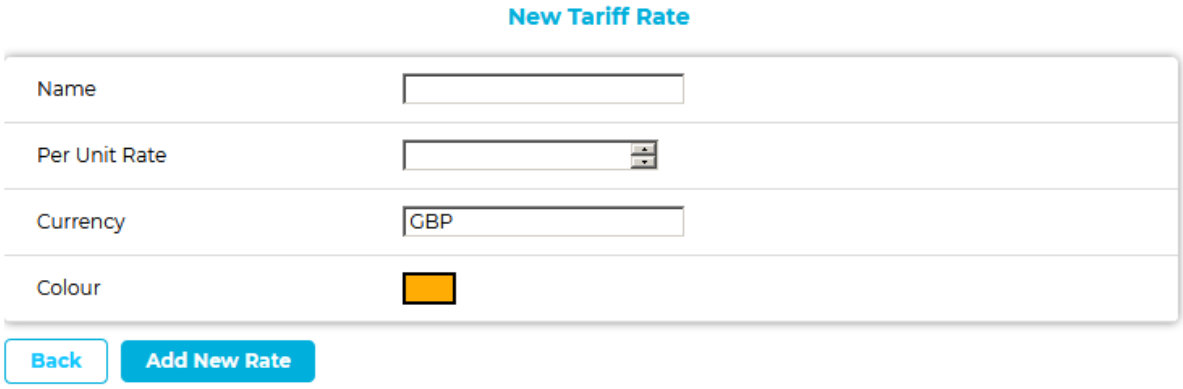


Figure 96

A 2.3.2 Creating Meter Tariffs

To Define a Meter Tariff:

1. Check the **Enable Tariffs** box in the **Meter Tariffs** window. See Figure 97 below:

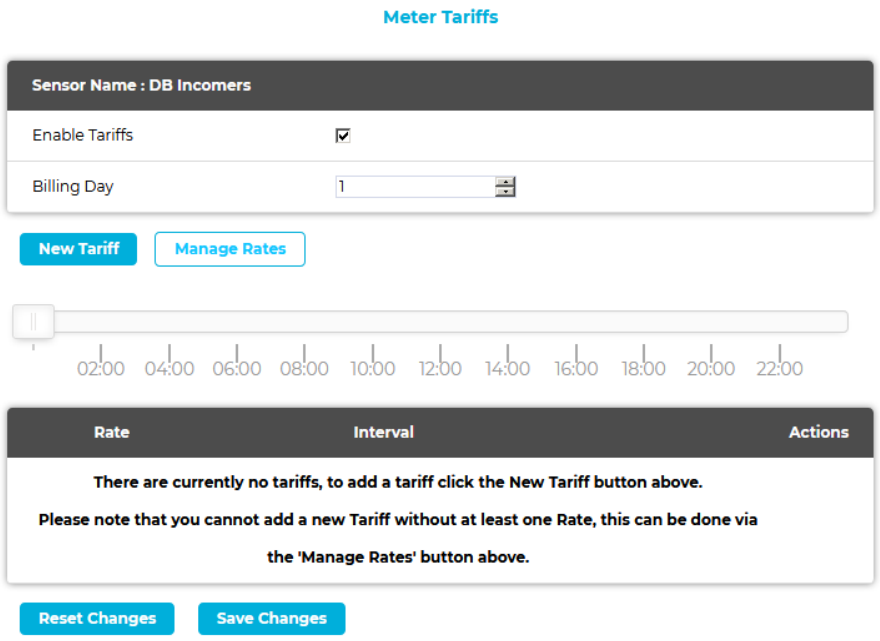


Figure 97

2. Click on **New Tariff** in the **Meter Tariffs** window.

   ➢ The **Meter Tariffs** window displays a **Test Rate** for the Tariff, highlighting the Slider bar with the Rate's defined colour (see Figure 94 above) as shown in Figure 98 below:

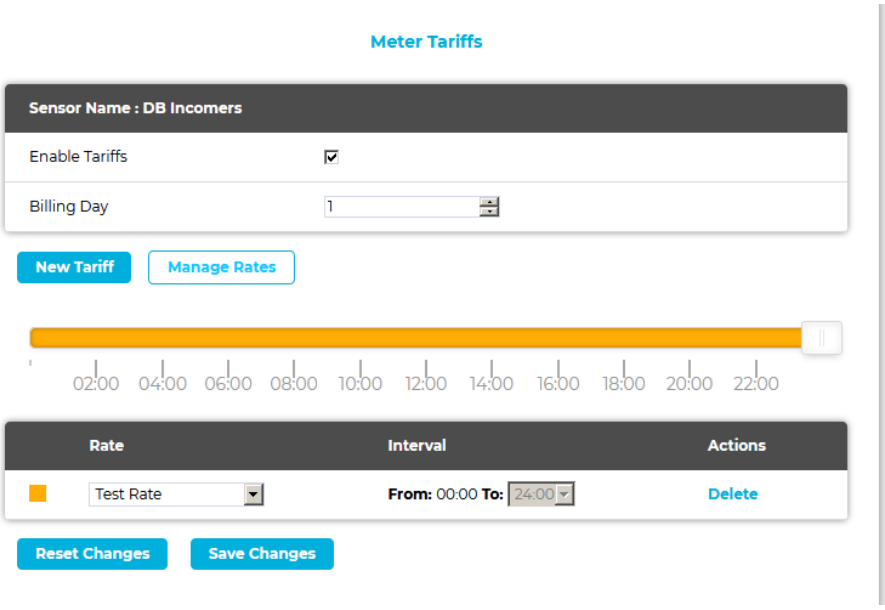


Figure 98

➢ By default, the first Rate defined in the **Rates** window (see Figure 92 above) is displayed.

Note: Initially, as only one Rate is associated with the Tariff, the Interval entry for the Rate will be inactive as the Rate will apply for the full 24 hour period.

➢ To allocate another Rate to the Tariff, click on the **Rate** drop down menu and select one of the displayed Rates. See Figure 99 below:

Figure 99

To Define Further Meter Tariffs:

1. Click on the **New Tariff** in the **Meter Tariffs** window.

➢ The new Tariff is displayed in the **Meter Tariffs** window. See Figure 100 below:

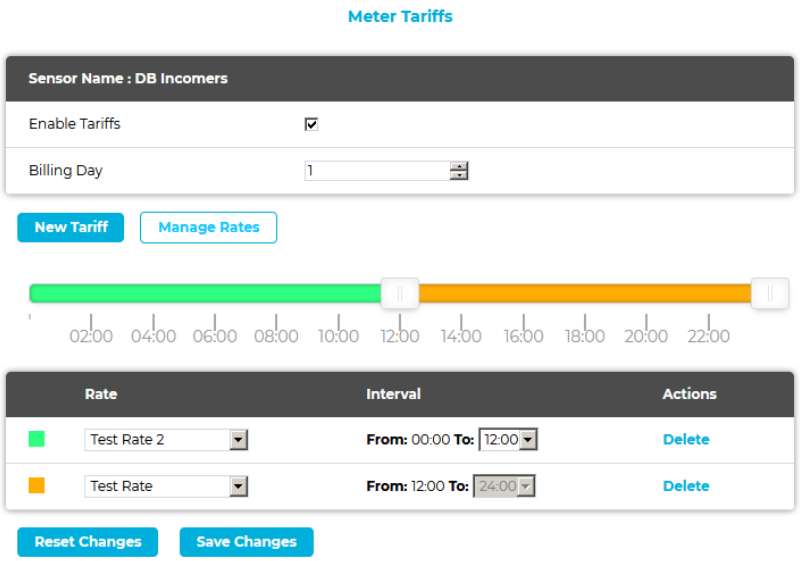


Figure 100

- The Slider bar shows the defined colours for each of the Rates allocated to the displayed Tariffs.
- By default each Tariff is allocated a 12 hour period of activity. These periods can be varied by:

  Either

  Moving the Slider left or right to adjust the time each Tariff is active for.

  Or

  Selecting a time from the **Interval** drop down list.

  See Figure 100 above.

  Note: The Interval drop down list will be inactive for the second Tariff added the time it is active in any 24 hour period is determined by the time period set for the first Tariff.

2. As with the first Tariff, select a Rate for it from its **Rate** drop down list. See Figure 99 above.

- Further Tariffs are added and their Rates selected in the same way. See Figure 101 below:

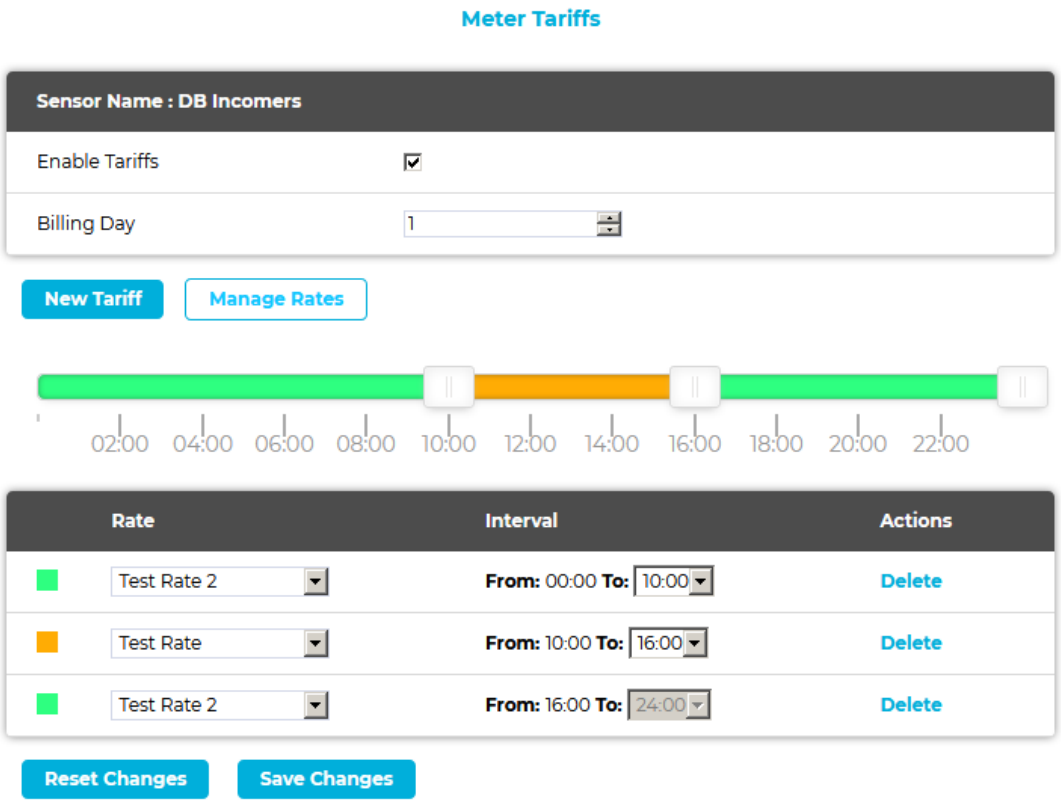


Figure 101

Note: The Interval drop down list will be inactive for the final Tariff added as the time it is active in any 24 hour period is determined by the time periods set for the first and second Tariffs.

3. When all Tariffs and associated Rates have been defined, click on Save Changes.

➢ The **Tariffs updated successfully** message is displayed. See Figure 102 below:

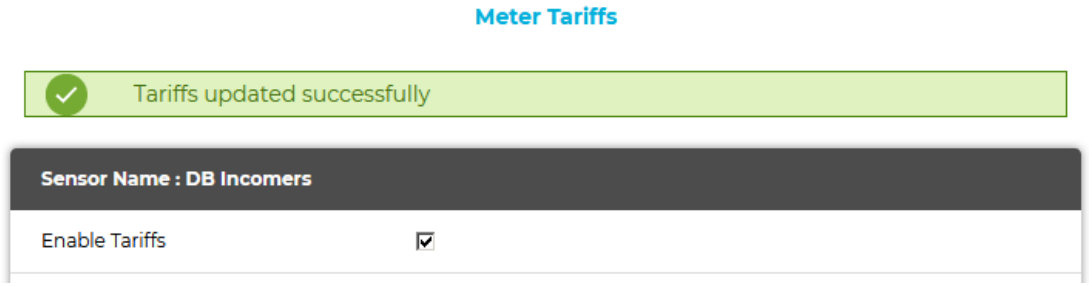


Figure 102

Appendix 3
Power Measurements from Current Clamps

In order to estimate the Power Usage from Current data, the **RMS System Voltage** and the **Power Factor** must be known.

- This information is not needed for direct electricity meter readings.

A brief summary is given below but, for more detail, please consult a standard textbook.

- The **Power Factor** is a measure of the degree of Phase Match between the Current and Voltage waveforms. With a resistive load this would be 100% (Power factor = 1.0, in phase) but, in reality, this is of the order of 0.7 overall.
  Typical values for various common loads can readily be found on the internet.
- For a **single-phase load** then Line Current is equal to Phase Current and the power usage is simply:

  System Voltage (typically 230V) * Current * Power Factor

- For a **three-phase load,** the situation is more complicated.
  In this case the Current Clamp will be measuring either Line Current or Phase Current.

  Star Configuration

  - In this configuration the current returns to Neutral and **Line Current** = **Phase Current**. The relevant System Voltage is just 230V (in the UK).

  Delta Configuration

  - In this configuration the current returns through the other phases and Line Current **IS NOT** equal to the Phase current.
  - If you are measuring **Line Current**, the relevant System Voltage is still 230V (in the UK).
  - If you are measuring **Phase Current**, the relevant System Voltage is 380V (in the UK) or **√(3) * 230V**.

    The Phase Current will be less than the Line Current by a factor of **√(3)**.
  - If the load switches between Star and Delta (e.g. large motors), Line Currents should be measured to give consistent results.
  - It should be noted that if the three-phase load is unbalanced, an error will be generated.
  - If the imbalance is severe i.e. Neutral Failure (Star) or Phase Failure (Delta), the results will not be useable.

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